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(54) **METHOD OF OUTPUTTING WEATHER/ENVIRONMENTAL INFORMATION FROM WEATHER/ENVIRONMENTAL SENSORS**

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(58) **Field of Classification Search**

CPC G01W 1/00; G06Q 10/06; G06Q 30/02

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,596,264 A * 7/1971 Ciemochowski 340/870.16
3,891,979 A * 6/1975 Braun et al. 340/581

(Continued)

FOREIGN PATENT DOCUMENTS

AU 2001277030 B2 3/2006
AU 2006204945 A1 7/2006

(Continued)

OTHER PUBLICATIONS

Enrique R. Vivoni et al, Real-time streaming of environmental field data, Computers & Geosciences 29 (2003) 457-468 (Year: 2003).*

(Continued)

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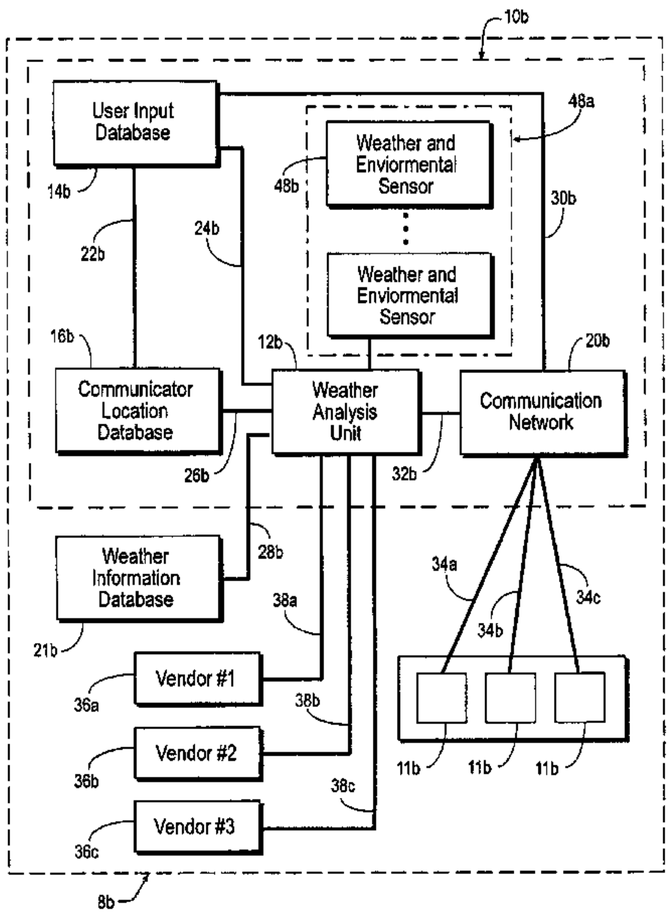
(57) **ABSTRACT**

A method of generating individualized real-time weather and environmental information, including receiving weather or environmental condition data from weather and environmental sensors, analyzing the data received from the sensors to generate weather and environmental information, and transmitting the information to a communicator device. The method may include determining a spatial range of a sensor and/or determining if a communicator device is within close proximity of a sensor. The sensors may be mounted in fixed locations along a roadway or a railway. The sensors may be approximately equidistant.

20 Claims, 4 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

4,015,366	A		4/1977	Hall, III	
4,222,044	A	*	9/1980	Boschung	340/581
4,438,439	A		3/1984	Shreve	
4,459,682	A		7/1984	Mossberg	
4,473,844	A		9/1984	Klein	
4,521,857	A		6/1985	Reynolds, III	
4,529,982	A		7/1985	Karlstrom et al.	
4,577,109	A		3/1986	Hirschfeld	
4,586,827	A		5/1986	Hirsch et al.	
4,755,942	A		7/1988	Gardner et al.	
4,774,658	A		9/1988	Lewin	
4,845,629	A	*	7/1989	Murga	G08G 5/0026 169/61
4,892,335	A		1/1990	Taft	
4,901,300	A		2/1990	Van Der Zande et al.	
4,945,355	A		7/1990	Blanchette	
4,972,319	A		11/1990	Delorme	
5,111,111	A		5/1992	Stevens et al.	
5,111,391	A		5/1992	Fields et al.	
5,117,353	A		5/1992	Stipanovich et al.	
5,122,959	A		6/1992	Nathanson et al.	
5,131,020	A		7/1992	Liebesny et al.	
5,164,904	A	*	11/1992	Sumner	G08G 1/0104 340/905
5,193,143	A		3/1993	Kaemmerer	
5,214,757	A	*	5/1993	Mauney	G01C 21/32 340/990
5,214,793	A	*	5/1993	Conway	G08G 1/096716 340/905
5,229,975	A	*	7/1993	Truesdell	G01S 7/64 367/107
5,250,955	A		10/1993	Major et al.	
5,265,024	A	*	11/1993	Crabill et al.	701/538
5,298,760	A		3/1994	Fuchs et al.	
5,365,290	A		11/1994	Suzuki et al.	
5,398,021	A		3/1995	Moore	
5,416,694	A		5/1995	Parrish et al.	
5,432,509	A	*	7/1995	Kajiwara	340/903
5,434,565	A		7/1995	Simon et al.	
5,442,147	A		8/1995	Burns et al.	
5,444,444	A		8/1995	Ross	
5,448,696	A		9/1995	Shimada et al.	
5,467,268	A		11/1995	Sisley et al.	
5,481,254	A		1/1996	Gaskill et al.	
5,486,830	A		1/1996	Axline, Jr. et al.	
5,488,697	A		1/1996	Kaemmerer	
5,493,709	A		2/1996	Duckeck et al.	
5,528,678	A		6/1996	Kaplan	
5,544,140	A		8/1996	Seagrave et al.	
5,550,981	A		8/1996	Bauer et al.	
5,555,446	A		9/1996	Jasinski	
5,565,863	A		10/1996	Simon et al.	
5,606,699	A		2/1997	De Pauw et al.	
5,607,187	A		3/1997	Salive et al.	
5,615,121	A		3/1997	Babayev et al.	
5,615,223	A		3/1997	Carr	
5,615,400	A		3/1997	Cowsar et al.	
5,628,050	A		5/1997	McGraw et al.	
5,629,854	A	*	5/1997	Schulte	G01C 21/3632 701/431
5,634,057	A		5/1997	Dickinson	
5,642,303	A		6/1997	Small et al.	
5,649,182	A		7/1997	Reitz	
5,671,412	A		9/1997	Christiano	
5,684,476	A		11/1997	Anderson	
5,689,650	A		11/1997	McClelland et al.	
5,703,930	A		12/1997	Miska et al.	
5,706,505	A		1/1998	Fraley et al.	
5,717,589	A		2/1998	Thompson et al.	
5,725,253	A		3/1998	Salive et al.	
5,754,782	A		5/1998	Masada	
5,757,322	A		5/1998	Ray et al.	
5,764,906	A		6/1998	Edelstein et al.	
5,768,577	A		6/1998	Kleewein et al.	
5,790,664	A		8/1998	Coley et al.	
5,790,953	A		8/1998	Wang et al.	
5,794,234	A		8/1998	Church et al.	
5,819,227	A		10/1998	Obuchi	
5,828,843	A		10/1998	Grimm et al.	
5,839,088	A		11/1998	Hancock et al.	
5,845,276	A		12/1998	Emerson et al.	
5,848,131	A		12/1998	Shaffer et al.	
5,848,378	A	*	12/1998	Shelton et al.	702/3
5,864,860	A		1/1999	Holmes	
5,864,875	A		1/1999	Van Huben et al.	
5,867,109	A		2/1999	Wiedeman	
5,867,110	A		2/1999	Naito et al.	
5,867,821	A		2/1999	Ballantyne et al.	
5,874,914	A		2/1999	Krasner	
5,880,958	A		3/1999	Helms et al.	
5,884,267	A		3/1999	Goldenthal et al.	
5,884,309	A		3/1999	Vanechanos, Jr.	
5,892,917	A		4/1999	Myerson	
5,893,905	A		4/1999	Main et al.	
5,898,680	A	*	4/1999	Johnstone et al.	370/316
5,948,041	A		9/1999	Abo et al.	
5,950,161	A		9/1999	Kozuma et al.	
5,963,130	A		10/1999	Schlager et al.	
5,974,447	A		10/1999	Cannon et al.	
5,978,730	A	*	11/1999	Poppen	G01C 21/3446 370/351
5,982,860	A	*	11/1999	Kim	H04M 1/654 379/100.01
5,991,735	A		11/1999	Gerace	
5,999,126	A		12/1999	Ito	
5,999,882	A		12/1999	Simpson et al.	
6,000,285	A		12/1999	Leslie et al.	
6,014,090	A		1/2000	Rosen et al.	
6,018,699	A	*	1/2000	Baron et al.	702/3
6,021,432	A		2/2000	Sizer, II et al.	
6,023,223	A	*	2/2000	Baxter, Jr.	G06Q 10/06 340/3.4
6,023,765	A		2/2000	Kuhn	
6,028,514	A		2/2000	Lemelson et al.	
6,031,455	A		2/2000	Grube et al.	
6,040,781	A		3/2000	Murray	
6,043,756	A		3/2000	Bateman et al.	
6,047,236	A		4/2000	Hancock et al.	
6,047,327	A		4/2000	Tso et al.	
6,049,776	A		4/2000	Donnelly et al.	
6,054,950	A		4/2000	Fontana	
6,055,434	A	*	4/2000	Seraj	G01S 5/0045 455/456.1
6,070,143	A		5/2000	Barney et al.	
6,078,260	A		6/2000	Desch	
6,084,510	A		7/2000	Lemelson et al.	
6,088,679	A		7/2000	Barkley	
6,091,956	A		7/2000	Hollenberg	
6,091,959	A		7/2000	Souissi et al.	
6,094,509	A		7/2000	Zheng et al.	
6,098,048	A		8/2000	Dashefsky et al.	
6,100,806	A		8/2000	Gaukel	
6,101,443	A	*	8/2000	Kato	G01C 21/3415 340/995.21
6,108,699	A		8/2000	Moiin	
6,112,074	A	*	8/2000	Pinder	455/404.2
6,112,075	A	*	8/2000	Weiser	455/404.1
6,133,853	A		10/2000	Obradovich et al.	
6,133,912	A		10/2000	Montero	
6,138,073	A		10/2000	Uchigaki	
6,144,739	A		11/2000	Witt et al.	
6,148,261	A		11/2000	Obradovich et al.	
6,161,092	A		12/2000	Latshaw et al.	
6,167,255	A		12/2000	Kennedy, III et al.	
6,177,873	B1	*	1/2001	Cragun	340/601
6,181,260	B1		1/2001	Simon et al.	
6,185,427	B1		2/2001	Krasner et al.	
6,199,045	B1		3/2001	Giniger et al.	
6,202,023	B1		3/2001	Hancock et al.	
6,204,761	B1	*	3/2001	Vanderable	340/539.28
6,209,026	B1		3/2001	Ran et al.	
6,212,393	B1		4/2001	Suarez et al.	
6,219,667	B1		4/2001	Lu et al.	

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,231,519 B1 5/2001 Blants et al.
6,233,122 B1 5/2001 Summers
6,240,369 B1 * 5/2001 Foust 702/3
6,252,539 B1 * 6/2001 Phillips et al. ..... 342/26 D
6,252,544 B1 6/2001 Hoffberg
6,255,953 B1 * 7/2001 Barber 340/601
6,266,612 B1 7/2001 Dussell et al.
6,266,683 B1 7/2001 Yehuda et al.
6,269,309 B1 7/2001 Buckingham
6,275,231 B1 8/2001 Obradovich
6,289,277 B1 * 9/2001 Feyereisen et al. 701/528
6,295,001 B1 * 9/2001 Barber 340/601
6,295,502 B1 9/2001 Hancock et al.
6,297,766 B1 * 10/2001 Koeller 342/357.31
6,329,904 B1 12/2001 Lamb
6,334,133 B1 12/2001 Thompson et al.
6,339,744 B1 1/2002 Hancock et al.
6,339,747 B1 1/2002 Daly et al.
6,343,255 B1 * 1/2002 Peek et al. 702/3
6,347,216 B1 2/2002 Marko et al.
6,351,218 B1 * 2/2002 Smith 340/601
6,356,834 B2 3/2002 Hancock et al.
6,360,172 B1 3/2002 Burfeind et al.
6,363,411 B1 3/2002 Dugan et al.
6,380,869 B1 4/2002 Simon et al.
6,381,535 B1 4/2002 Durocher et al.
6,396,397 B1 * 5/2002 Bos B60N 2/002 180/167
6,404,880 B1 * 6/2002 Stevens 379/221.11
6,405,134 B1 6/2002 Smith et al.
6,408,337 B1 6/2002 Dietz et al.
6,411,687 B1 6/2002 Bohacek et al.
6,411,809 B1 6/2002 Haakana et al.
6,418,371 B1 7/2002 Arnold
6,430,562 B1 8/2002 Kardos et al.
6,446,004 B1 9/2002 Cao et al.
6,449,488 B1 9/2002 Cheng et al.
6,456,852 B2 * 9/2002 Bar G01C 21/26 342/357.52
6,462,665 B1 * 10/2002 Tarlton et al. 340/601
6,469,664 B1 10/2002 Michaelson et al.
6,473,692 B2 10/2002 Hancock et al.
6,484,033 B2 11/2002 Murray
6,493,633 B2 * 12/2002 Baron et al. 702/3
6,496,776 B1 12/2002 Blumberg et al.
6,497,367 B2 12/2002 Conzola et al.
6,498,987 B1 * 12/2002 Kelly et al. 702/3
6,501,392 B2 12/2002 Gremmert et al.
6,505,123 B1 * 1/2003 Root et al. 702/3
6,519,571 B1 2/2003 Guheen
6,522,875 B1 2/2003 Dowling et al.
6,522,888 B1 2/2003 Garceran et al.
6,526,268 B1 2/2003 Marrah et al.
6,526,335 B1 2/2003 Treyz
6,531,218 B2 3/2003 Hoyt et al.
6,535,817 B1 3/2003 Krishnamurti
6,542,825 B2 4/2003 Jones et al.
6,552,682 B1 4/2003 Fan
6,553,317 B1 4/2003 Lincoln et al.
6,560,456 B1 5/2003 Lohtia et al.
6,564,143 B1 5/2003 Alewine et al.
6,571,279 B1 5/2003 Herz et al.
6,578,005 B1 6/2003 Lesaint et al.
6,587,813 B1 7/2003 Whitt et al.
6,587,831 B1 7/2003 O'Brien
6,587,851 B1 7/2003 Ditcharo et al.
6,590,529 B2 7/2003 Schwoegler
6,597,983 B2 7/2003 Hancock
6,603,405 B2 * 8/2003 Smith 340/905
6,609,062 B2 8/2003 Hancock
6,611,687 B1 8/2003 Clark et al.
6,633,900 B1 10/2003 Khalessi et al.
6,646,559 B2 11/2003 Smith
6,647,257 B2 11/2003 Owensby
6,650,902 B1 11/2003 Richton
6,650,972 B1 * 11/2003 Robinson et al. 701/3
6,654,689 B1 * 11/2003 Kelly et al. 702/3
6,658,568 B1 12/2003 Ginter et al.
6,675,151 B1 1/2004 Thompson et al.
6,677,894 B2 1/2004 Sheynblat et al.
6,678,700 B1 1/2004 Moore et al.
6,680,675 B1 1/2004 Suzuki
6,684,136 B2 1/2004 Sinex
6,697,859 B1 2/2004 Takahashi
6,700,482 B2 * 3/2004 Ververs et al. 340/500
6,708,211 B1 3/2004 Tingley et al.
6,714,793 B1 3/2004 Carey et al.
6,731,940 B1 5/2004 Nagendran
6,742,002 B2 5/2004 Arrowood
6,745,021 B1 6/2004 Stevens
6,745,036 B1 * 6/2004 Dunne G01S 5/00 455/422.1
6,751,553 B2 6/2004 Young et al.
6,753,784 B1 * 6/2004 Sznaideret al. 340/601
6,754,585 B2 6/2004 Root et al.
6,792,615 B1 9/2004 Rowe et al.
6,798,358 B2 9/2004 Joyce et al.
6,812,855 B1 11/2004 Sudou et al.
6,816,878 B1 11/2004 Zimmers et al.
6,823,263 B1 11/2004 Kelly et al.
6,823,315 B1 11/2004 Bucci et al.
6,823,344 B1 11/2004 Isensee et al.
6,826,481 B2 11/2004 Root et al.
6,829,233 B1 12/2004 Gilboy
6,829,334 B1 12/2004 Zirngibl et al.
6,829,536 B2 * 12/2004 Moore 702/3
6,836,730 B2 * 12/2004 Root et al. 702/3
6,838,998 B1 1/2005 Brown et al.
6,845,324 B2 1/2005 Smith
6,850,895 B2 2/2005 Brodersen et al.
6,853,915 B2 2/2005 Hubschneider et al.
6,861,959 B1 * 3/2005 Torres Sabate G08B 25/016 340/901
6,892,390 B1 5/2005 Lieberman et al.
6,909,361 B2 6/2005 McCarthy et al.
6,909,903 B2 6/2005 Wang
6,912,545 B1 6/2005 Lundy et al.
6,941,126 B1 9/2005 Jordan, Jr.
6,944,447 B2 9/2005 Portman et al.
6,962,531 B2 11/2005 Pace et al.
6,973,384 B2 12/2005 Zhao et al.
6,975,942 B2 12/2005 Young et al.
6,980,909 B2 12/2005 Root et al.
6,985,813 B2 1/2006 Root et al.
6,985,929 B1 1/2006 Wilson et al.
6,988,037 B2 1/2006 Root et al.
6,989,765 B2 1/2006 Gueziec
6,990,458 B2 1/2006 Harrison et al.
7,010,501 B1 3/2006 Roslak et al.
7,016,689 B2 3/2006 Clark et al.
7,024,205 B1 4/2006 Hose
7,024,310 B2 4/2006 Root et al.
7,031,724 B2 4/2006 Ross et al.
7,047,114 B1 5/2006 Rogers
7,053,780 B1 * 5/2006 Straub et al. 340/601
7,058,510 B2 6/2006 Kelly et al.
7,072,666 B1 7/2006 Kullman et al.
7,079,631 B1 7/2006 Kaufman
7,080,018 B1 7/2006 Fox et al.
7,084,757 B2 * 8/2006 Terui G08G 1/0104 340/436
7,084,775 B1 * 8/2006 Smith 340/601
7,089,115 B2 * 8/2006 Chapman et al. 702/3
7,089,116 B2 8/2006 Smith
7,096,276 B2 8/2006 Bodin et al.
7,103,596 B2 9/2006 Abe et al.
7,123,926 B2 10/2006 Himmelstein
7,139,664 B2 11/2006 Kelly et al.
7,171,372 B2 1/2007 Daniel et al.
7,181,345 B2 * 2/2007 Rosenfeld et al. 702/3
7,184,540 B2 2/2007 Dezonno et al.
7,184,896 B1 2/2007 Benson
7,185,044 B2 * 2/2007 Ryan et al. 709/200
7,191,064 B1 3/2007 Myers et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,191,065	B2	3/2007	Root et al.	
7,197,308	B2	3/2007	Singhal et al.	
7,212,811	B2	5/2007	Dowling et al.	
7,212,829	B1	5/2007	Lau et al.	
7,218,938	B1	5/2007	Lau et al.	
7,231,657	B2	6/2007	Honarvar et al.	
7,233,781	B2	6/2007	Hunter et al.	
7,242,988	B1	7/2007	Hoffberg et al.	
7,248,159	B2	7/2007	Smith	
7,254,481	B2	8/2007	Yamada et al.	
7,254,588	B2	8/2007	Sung et al.	
7,269,505	B2	9/2007	Zhao et al.	
7,284,000	B2	10/2007	Kuehr-Mclaren et al.	
7,284,033	B2	10/2007	Jhanji	
7,289,908	B2	10/2007	Root et al.	
7,299,492	B2	11/2007	Thrash et al.	
7,315,782	B2	1/2008	Root et al.	
7,321,305	B2	1/2008	Gollu	
7,327,271	B2	2/2008	Greenstein et al.	
7,330,112	B1	2/2008	Emigh et al.	
7,330,693	B1	2/2008	Goss	
7,337,146	B2	2/2008	Heelan et al.	
7,366,522	B2	4/2008	Thomas	
7,383,130	B1 *	6/2008	Koosam	702/3
7,397,390	B2 *	7/2008	DiPiazza	G08G 1/01 340/905
7,400,976	B2	7/2008	Young et al.	
7,403,925	B2	7/2008	Schlesinger et al.	
7,406,382	B2	7/2008	Brulle-Drews	
7,411,493	B2	8/2008	Smith	
7,421,344	B1 *	9/2008	Marsh et al.	702/3
7,426,203	B1	9/2008	McNamara et al.	
7,502,748	B1	3/2009	Baldwin et al.	
7,557,730	B2	7/2009	Gueziec	
7,567,575	B2	7/2009	Chen et al.	
7,568,217	B1	7/2009	Prasad et al.	
7,599,795	B1	10/2009	Blumberg et al.	
7,602,285	B2	10/2009	Sznaider et al.	
7,606,663	B2	10/2009	Neef et al.	
7,647,022	B2	1/2010	Ng et al.	
7,650,633	B2	1/2010	Whitson	
7,668,832	B2	2/2010	Yeh et al.	
7,716,077	B1	5/2010	Mikurak	
7,720,606	B2	5/2010	Burfeind et al.	
7,917,555	B2	3/2011	Gottumukkala et al.	
8,229,467	B2	7/2012	Root et al.	
8,483,651	B1	7/2013	Zamora et al.	
8,634,814	B2	1/2014	Root et al.	
8,769,480	B1	7/2014	Wagner et al.	
8,971,913	B2	3/2015	Moeglein et al.	
9,237,416	B2	1/2016	Root et al.	
9,392,460	B1	7/2016	Blake et al.	
2001/0029160	A1	10/2001	Aznal	
2001/0030624	A1 *	10/2001	Schwoegler	342/357.13
2001/0042001	A1	11/2001	Goto et al.	
2001/0045886	A1	11/2001	Minowa	
2001/0049584	A1	12/2001	Jones et al.	
2001/0049636	A1	12/2001	Hudda et al.	
2001/0051888	A1	12/2001	Mayhak et al.	
2001/0053999	A1	12/2001	Feinberg	
2002/0000930	A1	1/2002	Crowson et al.	
2002/0009353	A1	1/2002	Kelsey et al.	
2002/0010615	A1	1/2002	Jacobs	
2002/0025964	A1	2/2002	Streuff et al.	
2002/0029160	A1	3/2002	Thompson et al.	
2002/0040313	A1	4/2002	Hunter et al.	
2002/0048283	A1	4/2002	Lin	
2002/0049310	A1	4/2002	Tateishi et al.	
2002/0052674	A1	5/2002	Chang et al.	
2002/0062451	A1	5/2002	Scheidt et al.	
2002/0077876	A1	6/2002	O'Meara et al.	
2002/0091568	A1	7/2002	Kraft et al.	
2002/0095333	A1	7/2002	Jokinen et al.	
2002/0147642	A1	10/2002	Avallone et al.	
2002/0160745	A1	10/2002	Wang	
2002/0165732	A1	11/2002	Ezzeddine et al.	
2002/0173981	A1	11/2002	Stewart	
2002/0175211	A1	11/2002	Dominguez et al.	
2002/0183117	A1	12/2002	Takahashi et al.	
2002/0194366	A1	12/2002	Bodin et al.	
2003/0004780	A1	1/2003	Smith et al.	
2003/0004802	A1	1/2003	Callegari	
2003/0014297	A1	1/2003	Kaufman et al.	
2003/0028410	A1	2/2003	House et al.	
2003/0040849	A1	2/2003	Hathout et al.	
2003/0043073	A1	3/2003	Gray	
2003/0059158	A1	3/2003	Lacey	
2003/0060211	A1	3/2003	Chern et al.	
2003/0068974	A1	4/2003	Kanamaluru et al.	
2003/0100315	A1	5/2003	Rankin	
2003/0107490	A1	6/2003	Sznaider et al.	
2003/0113014	A1	6/2003	Katoh	
2003/0125963	A1	7/2003	Haken	
2003/0132298	A1	7/2003	Swartz et al.	
2003/0149607	A1	8/2003	Ogasawara et al.	
2003/0156049	A1	8/2003	Behr et al.	
2003/0169367	A1	9/2003	Ranta	
2003/0171870	A1	9/2003	Gueziec	
2003/0191765	A1	10/2003	Bargh et al.	
2003/0191795	A1	10/2003	Bernardin et al.	
2003/0198337	A1	10/2003	Lenard	
2003/0200027	A1	10/2003	Root et al.	
2004/0002348	A1	1/2004	Fraccaroli	
2004/0010372	A1	1/2004	Schwoegler	
2004/0010591	A1	1/2004	Sinn et al.	
2004/0023666	A1	2/2004	Moon et al.	
2004/0059996	A1	3/2004	Fasciano	
2004/0077347	A1 *	4/2004	Lauber	G08G 1/0962 455/428
2004/0093265	A1	5/2004	Ramchandani et al.	
2004/0107126	A1	6/2004	Kataoka et al.	
2004/0110515	A1	6/2004	Blumberg et al.	
2004/0130463	A1 *	7/2004	Bloomquist	G08G 1/096716 340/907
2004/0161097	A1	8/2004	Henry	
2004/0167813	A1	8/2004	Robertson et al.	
2004/0172343	A1	9/2004	Allibhoy et al.	
2004/0199655	A1	10/2004	Davies et al.	
2004/0203854	A1	10/2004	Nowak	
2004/0210479	A1	10/2004	Perkowski et al.	
2004/0221308	A1	11/2004	Cuttner et al.	
2004/0267595	A1	12/2004	Woodings et al.	
2005/0001720	A1	1/2005	Mason	
2005/0003828	A1	1/2005	Sugar et al.	
2005/0021666	A1	1/2005	Dinnage et al.	
2005/0021806	A1	1/2005	Richardson et al.	
2005/0021980	A1	1/2005	Kanai	
2005/0025132	A1	2/2005	Harper et al.	
2005/0027449	A1	2/2005	Marsh	
2005/0038876	A1	2/2005	Chaudhuri	
2005/0040847	A1	2/2005	Unger et al.	
2005/0049789	A1 *	3/2005	Kelly et al.	702/3
2005/0050008	A1	3/2005	Root et al.	
2005/0055374	A1	3/2005	Sato	
2005/0096962	A1	5/2005	Narasimhan et al.	
2005/0136917	A1	6/2005	Taylor	
2005/0136949	A1	6/2005	Barnes, Jr.	
2005/0136983	A1	6/2005	Agapi et al.	
2005/0154531	A1 *	7/2005	Kelly et al.	702/3
2005/0174235	A1	8/2005	Davis et al.	
2005/0181803	A1	8/2005	Weaver et al.	
2005/0192724	A1	9/2005	Hendry	
2005/0227709	A1	10/2005	Chang et al.	
2005/0228873	A1	10/2005	Tapuska et al.	
2005/0240378	A1	10/2005	Smith et al.	
2005/0243784	A1	11/2005	Fitzgerald et al.	
2005/0245243	A1	11/2005	Zuniga	
2005/0251370	A1	11/2005	Li et al.	
2005/0256781	A1	11/2005	Sands et al.	
2006/0009155	A1	1/2006	Paalasmaa et al.	
2006/0010467	A1	1/2006	Segel	
2006/0015254	A1 *	1/2006	Smith	702/3
2006/0020480	A1	1/2006	Hickey	
2006/0022846	A1	2/2006	Tummala	

(56) **References Cited**

U.S. PATENT DOCUMENTS

2006/0028400	A1	2/2006	Lapstun et al.
2006/0030354	A1	2/2006	Ho et al.
2006/0046740	A1	3/2006	Johnson
2006/0052090	A1	3/2006	Behr et al.
2006/0111089	A1	5/2006	Winter et al.
2006/0123053	A1	6/2006	Scannell
2006/0142024	A1	6/2006	Thalanany et al.
2006/0161469	A1	7/2006	Root et al.
2006/0164259	A1	7/2006	Winkler et al.
2006/0178140	A1	8/2006	Smith et al.
2006/0187017	A1	8/2006	Kulesz et al.
2006/0194595	A1	8/2006	Myllynen et al.
2006/0200480	A1	9/2006	Harris et al.
2006/0265238	A1	11/2006	Perrier et al.
2006/0271560	A1	11/2006	Mitchell
2006/0293065	A1	12/2006	Chew et al.
2006/0294147	A1	12/2006	Root et al.
2007/0001904	A1	1/2007	Mendelson
2007/0005363	A1	1/2007	Cucerzan et al.
2007/0021906	A1	1/2007	Yeh et al.
2007/0050128	A1	3/2007	Lee et al.
2007/0061300	A1	3/2007	Ramer et al.
2007/0061844	A1	3/2007	Hakusui et al.
2007/0072595	A1	3/2007	Pi et al.
2007/0094071	A1	4/2007	Seraji et al.
2007/0094262	A1	4/2007	Suzuki et al.
2007/0112511	A1	5/2007	Burfeind et al.
2007/0127423	A1	6/2007	Ho
2007/0162320	A1	7/2007	Joshi et al.
2007/0162328	A1	7/2007	Reich
2007/0168131	A1	7/2007	Root et al.
2007/0168524	A1	7/2007	Chao et al.
2007/0180119	A1	8/2007	Khivesara et al.
2007/0192159	A1	8/2007	Root et al.
2007/0197231	A1	8/2007	Lin
2007/0249323	A1	10/2007	Lee et al.
2007/0260531	A1	11/2007	Bezancon
2007/0260708	A1	11/2007	Beaton et al.
2007/0260741	A1	11/2007	Bezancon
2007/0270165	A1	11/2007	Poosala
2007/0270166	A1	11/2007	Hampel et al.
2007/0293240	A1	12/2007	Drennan
2008/0020702	A1	1/2008	Jendbro et al.
2008/0021645	A1	1/2008	Lau et al.
2008/0070550	A1	3/2008	Hose
2008/0082264	A1	4/2008	Hill et al.
2008/0084857	A1	4/2008	Gorti et al.
2008/0134043	A1	6/2008	Georgis et al.
2008/0134258	A1	6/2008	Goose et al.
2008/0140318	A1	6/2008	Breed
2008/0157990	A1	7/2008	Belzer et al.
2008/0160956	A1	7/2008	Jackson et al.
2008/0161012	A1	7/2008	Haran et al.
2008/0162036	A1	7/2008	Breed
2008/0183710	A1	7/2008	Serjeantson et al.
2008/0189028	A1	8/2008	Nair et al.
2008/0207183	A1	8/2008	Root et al.
2008/0270030	A1	10/2008	Copley
2008/0271120	A1	10/2008	Parkes et al.
2008/0275759	A1	11/2008	Parkes et al.
2008/0294478	A1	11/2008	Joshi et al.
2008/0313037	A1	12/2008	Root et al.
2008/0319652	A1	12/2008	Moshfeghi
2008/0319653	A1	12/2008	Moshfeghi
2009/0061903	A1	3/2009	Khokhar
2009/0073885	A1	3/2009	Jalil et al.
2009/0083150	A1	3/2009	Mashinsky
2009/0131080	A1	5/2009	Nadler et al.
2009/0156161	A1	6/2009	Strahs
2009/0176511	A1	7/2009	Morrison
2009/0176512	A1	7/2009	Morrison
2009/0177374	A1	7/2009	Liu
2009/0198641	A1	8/2009	Tortoriello
2009/0205036	A1	8/2009	Slaton et al.
2009/0209233	A1	8/2009	Morrison
2009/0210441	A1	8/2009	Mercer et al.
2009/0233575	A1	9/2009	Morrison
2009/0233633	A1	9/2009	Morrison
2009/0239511	A1	9/2009	Chen et al.
2009/0240428	A1	9/2009	Shahrestani
2009/0265099	A1	10/2009	Gottlieb
2009/0275348	A1	11/2009	Weinreich et al.
2009/0285483	A1	11/2009	Guven et al.
2009/0287587	A1	11/2009	Bloebaum
2009/0305645	A1	12/2009	Watanabe
2010/0009657	A1	1/2010	Dingler et al.
2010/0013629	A1	1/2010	Sznaider et al.
2010/0036717	A1	2/2010	Trest
2010/0042483	A1	2/2010	Hipsher
2010/0069052	A1	3/2010	Ahomaki et al.
2010/0069093	A1	3/2010	Morrison
2011/0066497	A1	3/2011	Gopinath et al.
2011/0128144	A1	6/2011	Baron et al.
2012/0085828	A1	4/2012	Ziegler
2012/0099756	A1	4/2012	Sherman et al.
2012/0116861	A1	5/2012	Dobyns
2012/0173075	A1	7/2012	Mays
2012/0229624	A1	9/2012	Calman et al.
2012/0229657	A1	9/2012	Calman et al.
2012/0278172	A1	11/2012	Mercuri et al.
2013/0029693	A1	1/2013	Bradley, Jr. et al.
2013/0046589	A1	2/2013	Grigg et al.
2013/0080055	A1	3/2013	Speier et al.
2013/0085673	A1	4/2013	Cavalcante et al.
2013/0091452	A1	4/2013	Sorden
2013/0165070	A1	6/2013	Hoffberg
2013/0290106	A1	10/2013	Bradley et al.
2013/0057551	A1	12/2013	Ebert et al.
2014/0137644	A1	5/2014	Root et al.
2014/0258109	A1	9/2014	Jiang et al.
2015/0182843	A1	7/2015	Esposito
2015/0186538	A1	7/2015	Yan
2017/0295265	A1	10/2017	Hala et al.

FOREIGN PATENT DOCUMENTS

AU	2007207616	A1	7/2007
AU	2006202473	A1	1/2010
AU	2012200288	A1	2/2012
CA	2 418 268	A1	1/2002
CA	2418268	A1	1/2002
CA	2514868	A1	8/2004
CA	2594001	A1	7/2006
CN	1230265	A	9/1999
CN	1449615	A	10/2003
CN	1659602	A	8/2005
CN	1745540	A	3/2006
CN	101083784	A	12/2007
CN	101120316	A	2/2008
CN	102682395	A	9/2012
EP	0436263	A1	7/1991
EP	0703463	A2	3/1996
EP	0798539	A2	10/1997
EP	1143399	A1	10/2001
EP	1303965	A2	4/2003
EP	1473684	A1	11/2004
EP	1593085	A2	11/2005
EP	1856608	A2	11/2007
EP	1912409	A1	4/2008
EP	1999665	A2	12/2008
EP	2115613	A2	11/2009
EP	2720481	A2	4/2014
GB	2201865	A	9/1988
GB	2216319	A	10/1989
JP	1065596	A	3/1989
JP	06508964		10/1994
JP	08221694	A	8/1996
JP	H10-65596	A	3/1998
JP	H1128879	A	2/1999
JP	11-136365	A	5/1999
JP	H11-215569	A	8/1999
JP	2000030148	A	1/2000
JP	2000167232	A	6/2000
JP	2001126170	A	5/2001

(56) **References Cited**

FOREIGN PATENT DOCUMENTS

JP	2001135285	A	5/2001
JP	2001175718	A	6/2001
JP	2001-229168	A	8/2001
JP	2001282831	A	10/2001
JP	2001290727	A	10/2001
JP	2002019928	A	1/2002
JP	2002028137	A	1/2002
JP	2002056156	A	2/2002
JP	2002162478	A	6/2002
JP	2002216021	A	8/2002
JP	2002251484	A	9/2002
JP	2002255465		9/2002
JP	2002255465	A	9/2002
JP	2002269335	A	9/2002
JP	2002303527	A	10/2002
JP	2002324075	A	11/2002
JP	2003099350	A	4/2003
JP	2003186900	A	7/2003
JP	2003187371	A	7/2003
JP	2003196284	A	7/2003
JP	2003208367	A	7/2003
JP	200245339	A	9/2003
JP	2003272078	A	9/2003
JP	2003280561	A	10/2003
JP	2003281694	A	10/2003
JP	2003281694	A	10/2003
JP	2003323528	A	11/2003
JP	2003323570	A	11/2003
JP	2003337874	A	11/2003
JP	2004505501	A	2/2004
JP	200427044	A	4/2004
JP	2004110496		4/2004
JP	2004511836	A	4/2004
JP	2004514333	A	5/2004
JP	2004157863	A	6/2004
JP	2004529543	A	9/2004
JP	2004282610	A	10/2004
JP	2004328308	A	11/2004
JP	2004334782	A	11/2004
JP	2004538558	A	12/2004
JP	2005073147	A	3/2005
JP	2005080208	A	3/2005
JP	2005094229	A	4/2005
JP	2005175896	A	6/2005
JP	2005184065	A	7/2005
JP	2005293255	A	10/2005
JP	2005-309489	A	11/2005
JP	2006011617	A	1/2006
JP	2006-48295		2/2006
JP	2006107136	A	4/2006
JP	2006113620	A	4/2006
JP	2006127144	A	5/2006
JP	2006198838	A	8/2006
JP	2006520497	A	9/2006
JP	2007-041642		2/2007
JP	2007-265449	A	10/2007
JP	2008305037	A	12/2008
JP	2009524150	A	6/2009
JP	2010530187	A	9/2010
JP	2011/242924	A	12/2011
KR	20010100635	A	11/2001
KR	20020090910	A	12/2002
KR	20030075238	A	9/2003
KR	20040010513	A	1/2004
KR	20050080370	A	8/2005
KR	20110012122	A	2/2011
KR	20140100173	A	8/2014
KR	20140100173	A	8/2014
TW	M445732	U	1/2013
WO	9607110	A1	3/1996
WO	9741654	A1	11/1997
WO	9802824	A1	1/1998
WO	9819479	A1	5/1998
WO	9923591	A1	5/1999
WO	1999057700	A1	11/1999
WO	0004730	A1	1/2000
WO	0004734	A1	1/2000
WO	0004737	A1	1/2000
WO	0013047	A1	3/2000
WO	0041104		7/2000
WO	200041104	A2	7/2000
WO	2001095140	A2	12/2001
WO	0209353	A2	1/2002
WO	200209353	A2	1/2002
WO	2002009353	A2	1/2002
WO	0221864	A1	3/2002
WO	0225964	A2	3/2002
WO	200225964	A2	3/2002
WO	2002025964	A2	3/2002
WO	WO 0221864		3/2002
WO	WO-02/28137	A1	4/2002
WO	02039217		5/2002
WO	200239217	A2	5/2002
WO	2002039732	A1	5/2002
WO	WO-02/39217	A2	5/2002
WO	0249310	A2	6/2002
WO	2002049310	A2	6/2002
WO	2003069576	A1	8/2003
WO	2004059996	A1	7/2004
WO	WO-2004/059996	A1	7/2004
WO	04070993	A2	8/2004
WO	2005040847	A2	5/2005
WO	06076460	A2	7/2006
WO	WO 2006/094086	A3	9/2006
WO	WO-2006094086	A2	9/2006
WO	WO-2006105088	A2	10/2006
WO	07084458	A2	7/2007
WO	WO-2008157334	A1	12/2008
WO	WO-2010/131629	A1	11/2010
WO	WO 2014/161078	A1	10/2014

OTHER PUBLICATIONS

Maxima Advantage Call Center CRM Solutions, vol. 18, No. 7, Jan. 2000.

MobileCentrex.com Web Pages, Mobile Centrex, Mar. 2003, Retrieved from Archive.orq Oct. 15, 2008.

Murrary R. Barrick et al., "The Big Five Personality Dimensions and Job Performance: A Meta-Analysis"; Personnel Psychology; Spring 1991; vol. 44; No. 1, pp. 1-26.

Myers, "Personal Digital Radio Service," IBM Technical Disclosure Bulletin, Aug. 1995, pp. 315-316, vol. 38, No. 8, IBM Corporation, Armonk, New York, USA.

Author Unknown, "The Nexterna Clearview Dispatch Module," 2005, 2 pp., Nexterna Limited, Burlington, Ontario, Canada.

Author Unknown, "Dispenser Services Inc. Selects Web-Based Field Resource Management Solution From Nexterna," PR Newswire, Aug. 14, 2002, 2 pp., ProQuest LLC, New York, NY, USA.

Author Unknown, "Nexterna Announces Newest Release of Nexterna Clearview," PR Newswire, Sep. 26, 2002, 2 pp., ProQuest LLC, New York, NY, USA.

Author Unknown, "Nexterna.com Web Pages Nexterna Inc. 2002-2003," retrieved from Archive. Org on May 20 2009, 31 pp.

Author Unknown, "Nexterna Optitrac," Nexterna Inc. 2002-2003, retrieved from Archive.Org on May 20, 2009, pp. 32-38.

Bisio, et al., "Effective Resource Scheduling in Work Force Management Context for Telecommunication Work Centers," Centro Studi E. Laboratori Telecommunicazioni Via G. Reiss Romoli, 1999, pp. 1-5, vol. 274, Torino, Italy.

Boselly III, et al., "Road Weather Information Systems vol. 2: Implementation Guide," Strategic Highway Research Program, 1993, pp. 1-82, National Academy of Sciences, Washington, DC, USA.

Collins, et al., "Automated Assignment and Scheduling of Service Personnel," AI in Corporate Service & Support, Apr. 1994, pp. 33-39, IEEE Expert.

Author Unknown, "Computer-Assisted Dispatch," definition retrieved from Wikipedia.org on Oct. 15, 2008, 15 pp.

Author Unknown, "Dispatch (Logistics)," definition retrieved from Wikipedia.org on Oct. 15, 2008, 11 pp.

(56) **References Cited**

OTHER PUBLICATIONS

Feldman, et al., "Making Cell Phones Indispensable for Techs," Contractor, Jul. 2004, pp. 40 & 54, vol. 51, No. 7, ABI/INFORM Global.
Author Unknown, "iMedeon Announces Support for Microsoft Windows CE Devices for its Wireless Web-based Mobile Workforce Management Applications," Business Wire, Feb. 5, 2001.
Jing, et al., "WHAM: Supporting Mobile Workforce and Applications in Workflow Environments RIDE 2000," Research Issues in Data Engineering, Feb. 2000, 8 pp.
Kruse, "Snow and Ice Go Hi-Tech," Mobile Radio Technology Magazine, Oct. 1, 1999, pp. 1-4.
Lesaint, et al., "Dynamic Workforce Management," AI for Network: Management Systems, Apr. 14, 1997, pp. 1-5, IEE, London, UK.
Author Unknown, "TMC Labs Reviews—Maxima Advantage," Call Center CRM Solutions, Jan. 2000, 4 pp., vol. 18, No. 7, ABI/Inform Global.
Author Unknown, "MDSI Mobile Data Solution—Innovative and Effective Mobile Workforce Management," MDSI-Advantex.com, Feb. 1999, 19 pp.
Author Unknown, "MobileAria and WeatherBank Announce Partnership to Avert Delays, Increase Driver Productivity," Business Wire, Jun. 26, 2001, pp. 1-2, ProQuest LLC, New York, NY, USA.
Author Unknown, "Real-Time Wireless Workforce Solutions—MC Field Manager," Mobile Centrex Inc., retrieved from Archive.org on Oct. 15, 2008, 7 pp.
Author Unknown, "Real-Time Wireless Workforce Solutions—With Mobile Centrex You Can . . . ," Mobile Centrex Inc., retrieved from Archive.org on Oct. 15, 2008, 5 pp.
Author Unknown, "Real-Time Wireless Workforce Solutions—Features That Work for You," Mobile Centrex Inc., retrieved from Archive.org on Oct. 15, 2008, 10 pp.
Partyka, et al., "On the Road to Service," ORMS Today, Aug. 2000, pp. 1-8, Lionheart Publishing, Inc., Marietta, GA, USA.
Rhinehart, "City Uses GIS to Monitor Snow-Fighting Fleet," The American City & County, Apr. 1999, p. 31, vol. 144, No. 4, ABI/Inform Global.
Timmins, "Mobile Workers Sync Up—PeopleSoft, Eduprise.com Team for KCVU," IT Support News, Dec. 1999, pp. 28 & 30, vol. 19, No. 13, ProQuest Computing.
Author Unknown, "Vantive and MDSI to Provide Enterprise Wide Wireless Field Service Solution," PR Newswire, Oct. 26, 1998, pp. 1-3, ProQuest LLC, New York, NY, USA.
Author Unknown, "Visual Staff Scheduler Pro Version 3.0 User Guide," 1997, pp. 1-152, Atlas Business Solutions, Inc.
Weigel, et al., "Applying GIS and OR Techniques to Solve Sears Technician-Dispatching and Home-Delivery Problems," Interfaces, Jan.-Feb. 1999, pp. 112-130, vol. 29, No. 1, Institute for Operations Research and Management Sciences.
Author Unknown, "iMedeon Announces Support for Microsoft Windows CE Devices for its Wireless, Web-Based Mobile Workforce Management Applications," Business Wire, Feb. 5, 2001, 2 pp., ProQuest LLC, New York, NY, USA.
Howard County Bureau of Highways, "Web-Enabled Snowplow Tracking System," Howard County, 1999, pp. 1-11.
Author Unknown, "Motorola iRadio(TM) System Hits the Road at Consumer Electronics Show 2001," PR Newswire, Jan. 4, 2001, pp. 1-2, ProQuest LLC, New York, NY, USA.
Le Comte, "Using Your Computer—Software Review," Weatherwise, Aug. 1991, pp. 48-51, vol. 44, No. 4.
Freedman, "Pinpoint Weather," Technology Review, Jun. 2003, pp. 52-58, vol. 106, No. 5, ABI/Inform Global.
Author Unknown, "Yahoo! and Weather.com Forge Multi-National Agreement to Provide Enhanced Weather Reports," Business Wire, Jan. 7, 2002, pp. 1-3, ProQuest LLC, New York, NY, USA.
Ohta, et al., "Real-World Community Platform: Mobile Multi-User Communication System," Multimedia Laboratories, NTT DoCoMo, Inc., 2000, pp. 601-606.
Lee, et al., "Statistical Analysis with Arcview GIS," 2001, pp. 1-192, John Wiley & Sons, Inc., New York, NY, USA.
Ohbuchi, et al., "Shape-Similarity Search of Three-Dimensional Models Using Parameterized Statistics," Oct. 9-11, 2002, in the Proceedings of the 10th Pacific Conference on Computer Graphics and Applications, pp. 265-274, IEEE.
Myers, "Personal Digital Radio Service," IBM Technical Bulletin, vol. 38, No. 8, p. 315, Aug. 1995.
Oh et al., "A Model for Role Administration Using Organization Structure",SACMAT '02, Jun. 3-4, 2002, pp. 155-162.
Botha, R.A. et al., "Separation of duties for access control enforcement in workflow environments", IBM Systems Journal, vol. 40, No. 3, 2001, pp. 666-682.
What is Access Management?, 2AB Inc., Jan. 2004, 6 pages.
Harris, Shon, Mike Myer's Certification Passport CISSP, McGraw-Hill, 2002, ISBN 0-07-222578-5, Chapter 2, 54 pages.
Park, Joon S. et al., "Role-Based Access Control on the Web", ACM Transactions on Information and System Security, vol. 4, No. 1, Feb. 2001, pp. 37-71.
McCormick, Vickie L., "Using HR Information systems for HIPAA role-vased access compliance", Journal of Health Care Compliance, vol. 5, No. 2, Mar./Apr. 2003, pp. 31-32.
Langforn, Jeff, "Implementating Least Privilege at your Enterprise", SANS Institute, Jul. 5, 2003, 21 pages.
Cuppens, Frederick et al., "Modeling Contexts in the Or-BAC Model", ACSAC'03, 2003, pp. 1-10.
Principles of Least Privilege definition, Wikipedia.org, Reprinted Jul. 11, 2012, 5 pages.
Sakagumi et al., "ActiveTrace: Mobile Marketing Platform for Location and Behavior-Dependent Information Distribution and Analysis," Collection of Papers/Multimedia, Distribution, Collaboration and Mobile (DICOMO) Symposium, Jun. 27, 2001, vol. 2001, Abstract No. 7, pp. 501-506.
International Search Report for PCT/US2016/053456 dated Jan. 5, 2017.
International Search Report for PCT/US2016/066198 dated Mar. 9, 2017.
International Search Report PCT/US2017/012155, dated Apr. 30, 2017.
International Patentability Report and Written Opinion issued for PCT/US2015/067694 dated Jun. 27, 2017.
Mcnamee, Ethical Issues Arising From the Real Time Tracking and Monitoring of People Using GPS-Based Location Services.

* cited by examiner

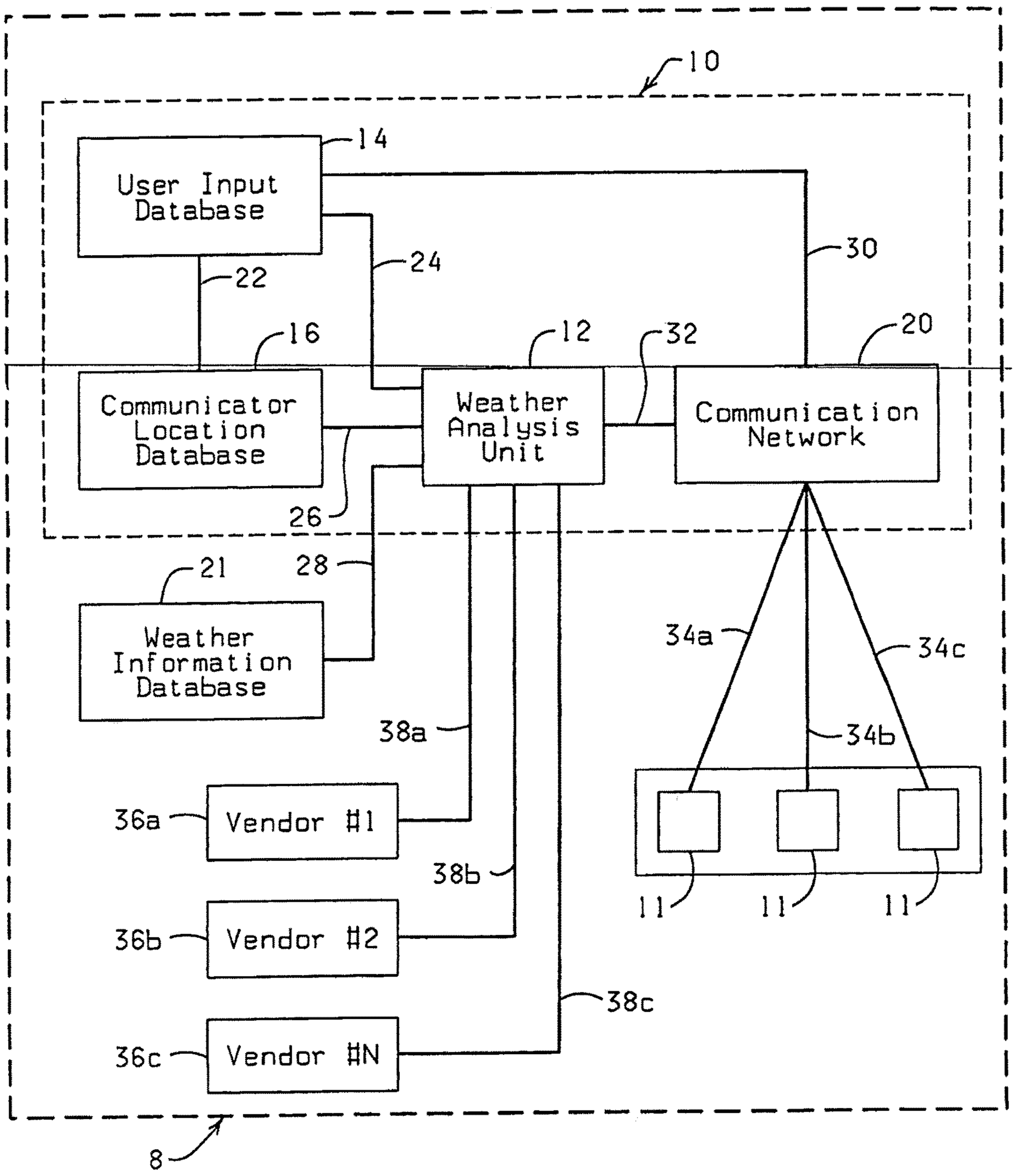

10
14
User Input Database
22
24
30
16
12
32
20
Communicator Location Database
Weather Analysis Unit
Communication Network
26
28
21
Weather Information Database
34a
34c
34b
38a
36a
Vendor #1
38b
11
11
11
36b
Vendor #2
38c
36c
Vendor #N
8

Fig. 1

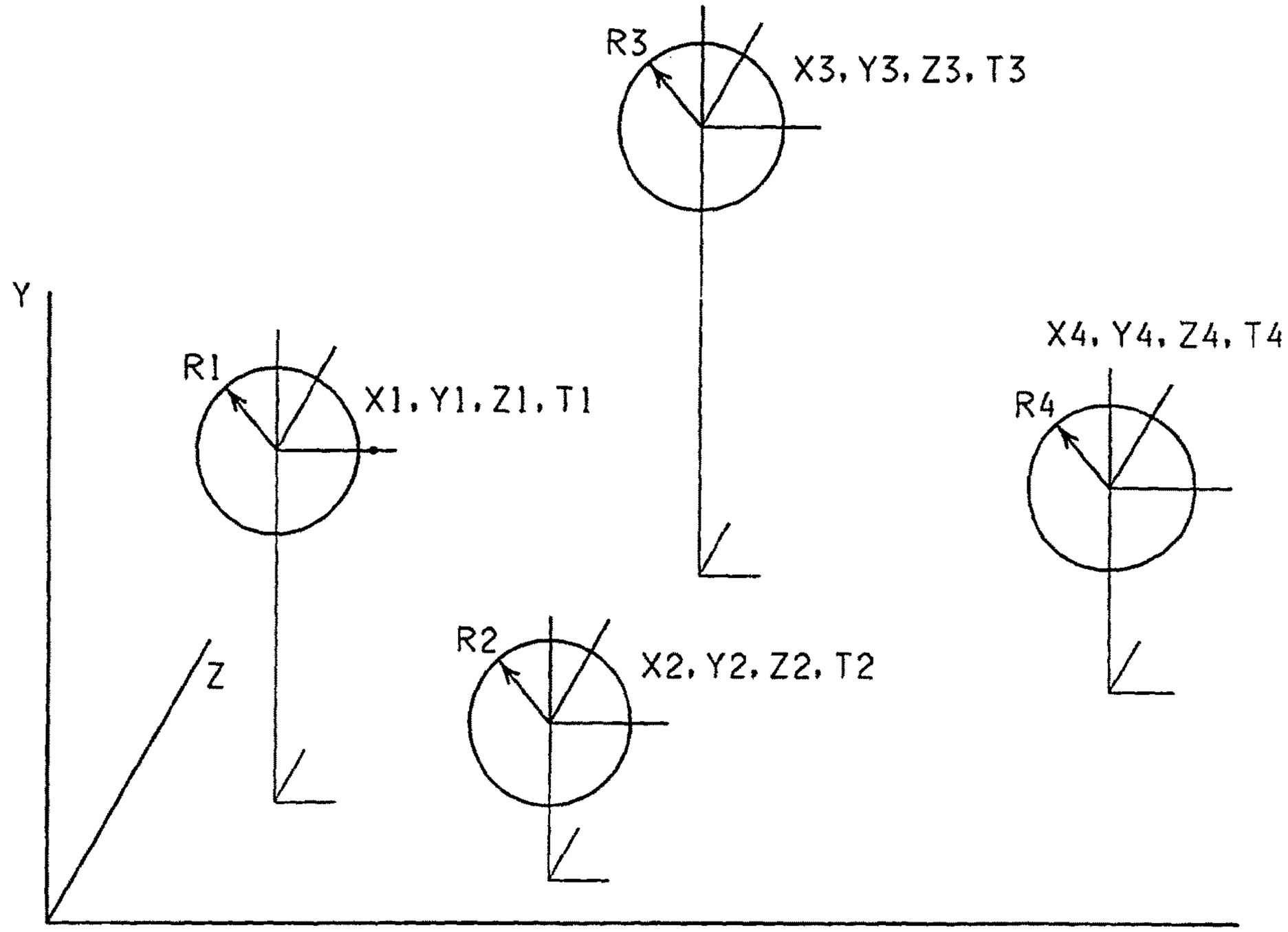


FIG. 2

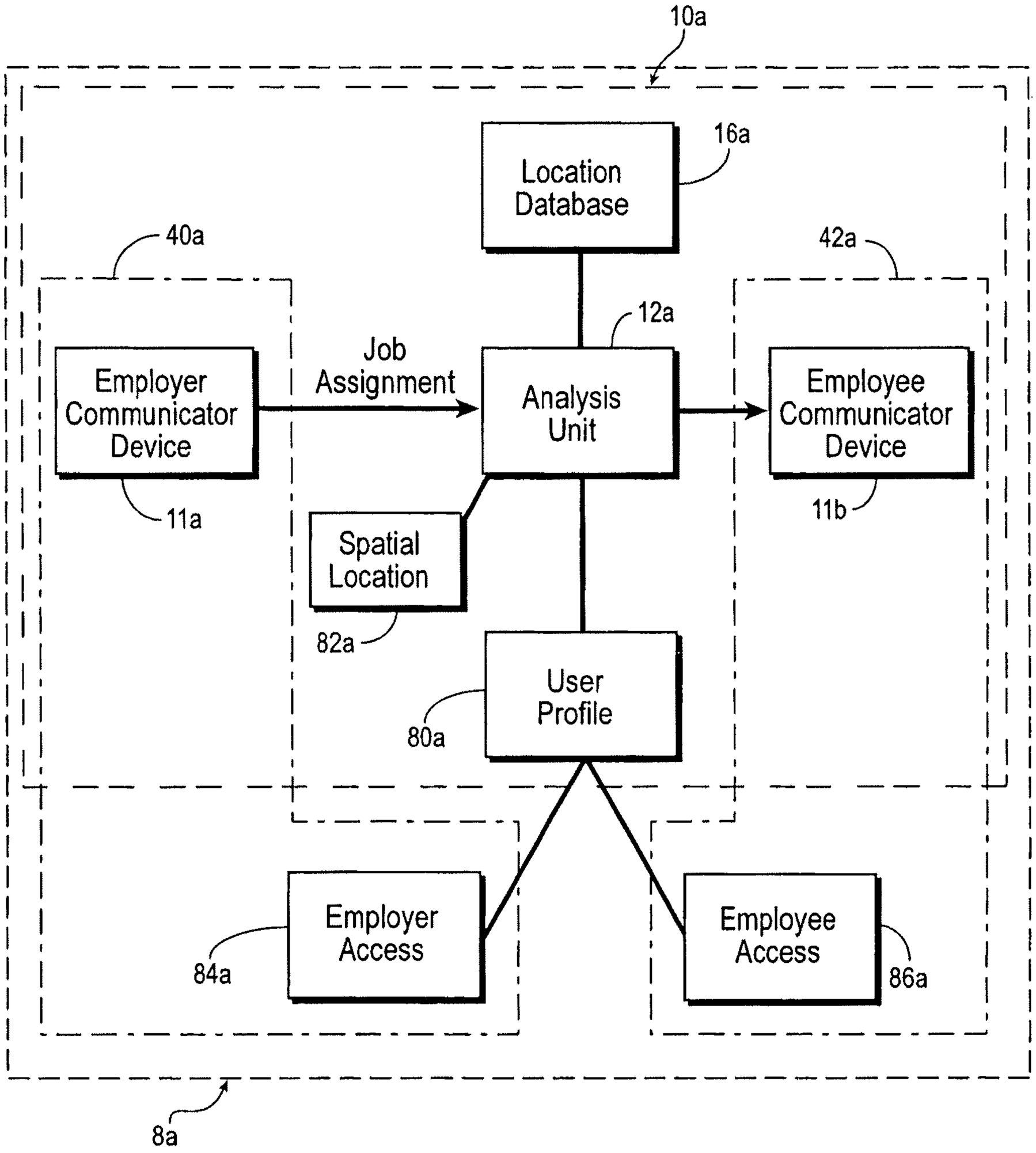
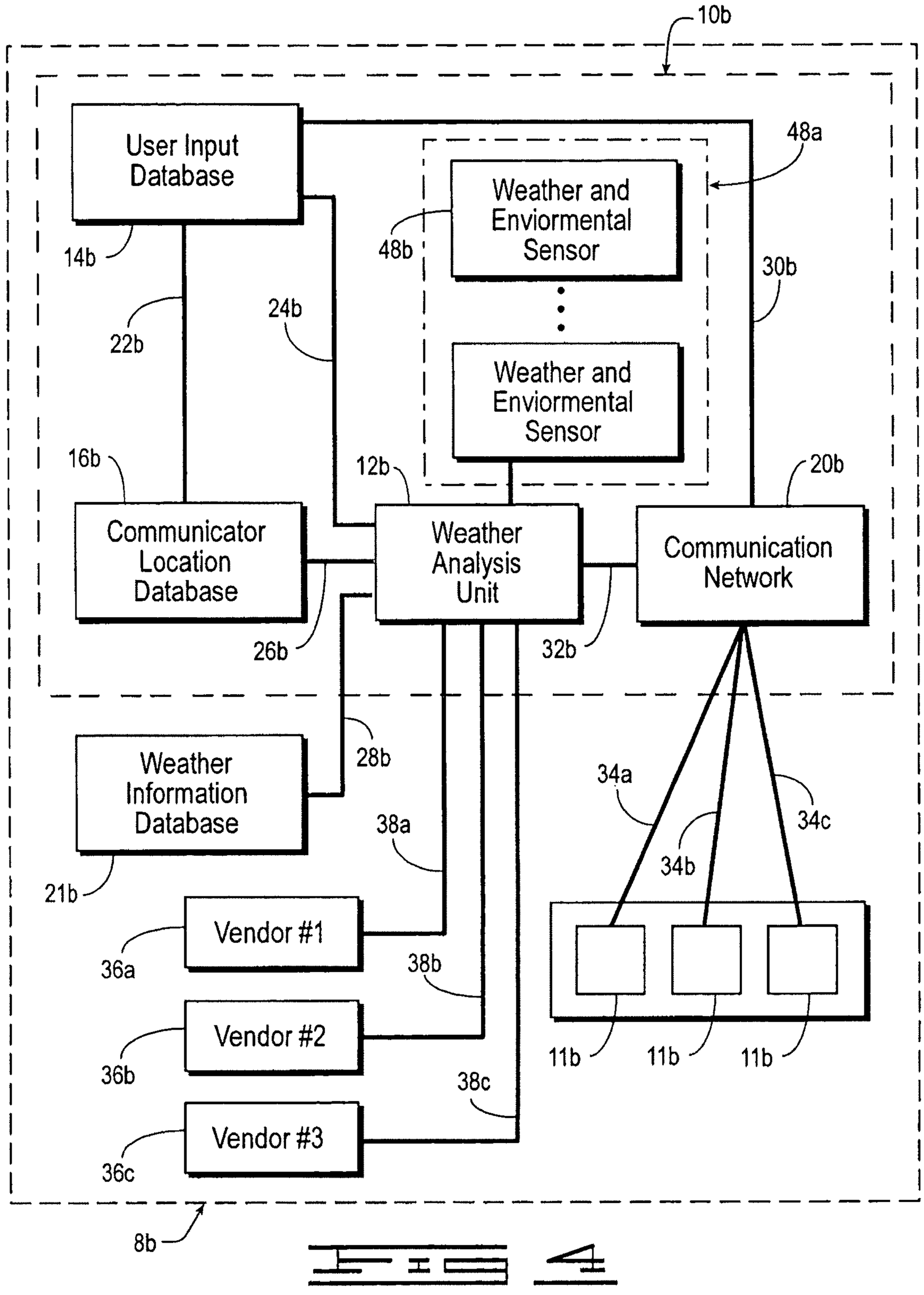

10a
16a
Location Database
40a
42a
12a
Job Assignment
Employer Communicator Device
Analysis Unit
Employee Communicator Device
11a
11b
Spatial Location
82a
User Profile
80a
Employer Access
84a
Employee Access
86a
8a

FIG 3


10b
User Input Database
14b
22b
24b
48a
Weather and Enviormental Sensor
48b
Weather and Enviormental Sensor
30b
16b
12b
20b
Communicator Location Database
Weather Analysis Unit
Communication Network
26b
32b
28b
Weather Information Database
21b
34a
34b
34c
38a
Vendor #1
36a
38b
Vendor #2
36b
38c
Vendor #3
36c
11b
11b
11b
8b

METHOD OF OUTPUTTING WEATHER/ENVIRONMENTAL INFORMATION FROM WEATHER/ENVIRONMENTAL SENSORS

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application is a Continuation of U.S. patent application Ser. No. 11/035,654, filed Jan. 14, 2005, the disclosure of which is hereby incorporated by reference in its entirety.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not applicable.

BACKGROUND OF THE INVENTION

During recent years, the demand for detailed information, such as for example weather information, has risen sharply. Personal computers and communication devices have increased the demand for more information because of their power to gather, manipulate, transmit and receive data. As a result, specialized information and value-added services are in great demand. End users no longer desire to gather, manipulate and evaluate raw data. For instance, nowhere is this condition more apparent than with weather services across North America.

Years ago, radio and television broadcasters recognized an increasing demand for weather information from their audience, and thus increased the number of on-air weather segments as a means for increasing market ranking. Today, the demand for specific content in weather information has exceeded the ability of broadcasters to meet this demand. Virtually every facet of business and personal activities are continually influenced by the weather, good or bad.

In the United States as in most countries, a governmental agency (the National Weather Service in the United States), has the primary responsibility of generating weather products for the general public. These products, such as advisories, statements, and forecasts are generated and made available to third parties, such as broadcasters, newspapers, internet web sites, paging companies and others who, in turn, distribute them to the public. However, this chain of data custody is one way.

Today's lifestyles are fast-paced and sophisticated. Requests for detailed weather information for specific applications outnumber the governments' ability to process them. However, adhering to their mandated responsibility, the National Weather Service generates the general products for public consumption twice daily. This condition forces the public to interpret general and outdated advisories to meet their needs. Often, this interpretation is made erroneously. Even worse, these products are usually regional or national in scope, and may not apply to a particular location where various local activities are underway.

By way of example, weather warnings are broadcast by radio stations across the United States. These warnings identify certain weather impacts within a specified area. In most cases, the warning area includes one or more counties, covering dozens to hundreds of square miles. Most often, these threats (such as severe thunderstorms, tornadoes, etc.), only impact a very small zone within the warning area. These threats also move rapidly. As impacts approach specific zones, they are in fact, moving away from other zones,

inside the total warning area. Essentially, the existing reporting system is insufficient to specifically identify and adequately warn of personal risk. Furthermore, if the threat is imminent, the existing system cannot and does not provide preventive measures for each user near or at the threat. Thus, by default, distant or unaffected users are placed "on alert" unnecessarily when the threat may be moving away from their location.

Another common example further clarifies the problem. A family, excited to attend the championship softball game this upcoming weekend, closely monitors the local weather forecast. All week-long the forecast has advised fair to partly cloudy weather for game day. Early on game day, the forecast changes to partly cloudy, with a thirty percent chance for late afternoon showers. The family decides to attend the game, believing that the chances for rain are below their perceived risk level. Unknown to the family at midday, some clusters of showers are intensifying, and will place dangerous lightning over the game field. While the morning weather report was not completely inaccurate, the participants and spectators are exposed to risk. If later asked, it is likely the family members did not hear or remember the weather forecast. They also failed to link their limited knowledge of the weather to their own needs and risk exposure. They did not monitor changing weather events. Most likely, they had no ability to monitor developing risk at the game. Clearly, these people were forced to interpret outdated, limited information as applied to their specific application.

Therefore, a need exists for a system to automatically and continuously provide consumer customized reports, advisories, alerts, forecasts and warnings relevant to a consumer-defined level of need or dynamic spatial location. It is to such a system that the present invention is directed.

SUMMARY OF THE INVENTION

The present invention provides an interactive advisory system and method of delivering individualized information. More specifically, the present invention relates to a broadcast network for selectively transmitting individualized output signals to remote communicator devices. The broadcast network includes a user input database, a communicator location database, an analysis unit and a communication network.

The user input database contains user-defined parameters and each of the user-defined parameters desirably includes a spatial range identifier and a user profile. The user profile in each of the user-defined parameters at least identifies a communicator device associated with a particular user. The communicator location database contains real-time data indicative of the spatial locations of the communicator devices. In one preferred version of the present invention, the communicator location database is automatically and/or continuously updated by the communicator devices.

The information database contains data, such as real-time weather data for at least the spatial locations contained in the communicator location database. The term "data" describes a wide variety of products including, but not limited to, past and current conditions of weather events, textual products, graphic products, and the like. The analysis unit receives the real-time data from the information database, and automatically and continuously compares the spatial range identifier included in the user-defined parameters and the spatial locations of the corresponding communicator devices contained in the communicator location database with the real-time data and, upon demand of the user, or even

continuously, generates an individualized output signal such as weather information within the spatial range identified by the spatial range identifier for the user-defined parameters. As new locations are defined by the communicator location database, the information database is automatically updated in real-time.

The communication network transmits each individualized output signal to the particular communicator device defined in the user profile included in the user-defined parameter corresponding with the real-time data and prediction of events. Thus, a user can receive information in real-time specific to the user's immediate spatial location regardless of whether or not the user's location remains fixed or dynamic throughout time.

Other advantages and features of the present invention will become apparent to those skilled in the art when the following detailed description is read in view of the attached drawings and appended claims.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. **1** is a block diagram of an interactive weather advisory system constructed in accordance with the present invention.

FIG. **2** is a coordinate system illustrating a spatial location identifier and a spatial range identifier utilized by versions of the present invention.

FIG. **3** is a block diagram of an interactive advisory system constructed in accordance with the present invention.

FIG. **4** is a block diagram of an interactive weather advisory system constructed in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings and more particularly to FIG. **1** shown therein in block diagram form, is one embodiment of the invention in the form of an interactive weather advisory system constructed in accordance with the present invention. The weather advisory system **8** is provided with a broadcast network **10** for selectively transmitting individualized weather output signals to remote communicator devices **11**. The broadcast network **10** includes a weather analysis unit **12**, a user input database **14**, a communicator location database **16**, and a communication network **20**. The weather analysis unit **12** receives real-time weather data from a weather information database **21**. The weather information database **21** can be located at the broadcast network **10**, or remotely from the broadcast network **10**. The weather analysis unit **12**, the user input database **14**, the communicator location database **16**, the weather information database **21**, and the communication network **20**, interrelate and communicate via signal paths **22**, **24**, **26**, **28**, **30** and **32**.

The user input database **14** permits a plurality of users to input data corresponding to the weather reports, advisories or forecasts such that individualized weather reports, advisories or prediction of events can be transmitted to each individual user. The user input database **14** contains data representative of at least one user-defined parameter correlated to each one of a plurality of users. In one version of the present invention, each of the user-defined parameters includes various information related to weather output signals, such as a spatial range identifier, a user profile, one or more weather content identifiers for identifying particular weather patterns, one or more time identifiers for identifying particular times or time intervals that a user may desire a weather product, a spatial location fixed or dynamic code, and a spatial location identifier for identifying particular spatial locations of interest to the user if the spatial location fixed or dynamic code indicates that the spatial location is to be fixed. The user profile in each of the user-defined parameters includes at least a user identifier code for identifying a particular communicator device **11** associated with a particular user.

For instance, the user identifier code could be a mobile telephone number identifying one of the communicator devices **11**, which in this instance could be a mobile telephone or a pager, for example. The weather content identifier could be a computer code to identify one or a variety of weather conditions or events such as tornadoes, thunderstorms, hail storms, lightning storms, showers, snow storms, blizzards, high winds, winds aloft, rapidly rising or rapidly falling barometric pressure or other such weather patterns or conditions. The time identifier desirably could be a computer code for identifying the particular time, times, or time intervals the user desires the interactive weather advisory system **8** to communicate weather data to the user or to monitor the real-time weather data for a particular time and/or date. The spatial location identifier **26** could be a computer code identifying a particular predetermined spatial location such as, by way of example but not limitation, a longitude and latitude anywhere in the world, a town, a county, a township, address, zip code, altitude and combinations thereof.

As discussed above, the spatial location identifier identifies a particular spatial location anywhere in the world and/or altitude above sea level. The spatial range identifier identifies a particular spatial range surrounding the spatial location identifier. Each of the users can select the spatial location identifier and the spatial range identifier so as to receive weather forecasts and/or weather advisories or any other weather information for the spatial location identified by the spatial location identifier, and within the spatial range identified by the spatial range identifier.

For example, referring to FIG. **2**, shown therein is a coordinate system illustrating four spatial location identifiers and four spatial range identifiers selected by different users of the present invention. That is, one of the users selects the spatial location identifier (X1, Y1, Z1), and the spatial range identifier (R1). Another one of the users selects the spatial location identifier (X2, Y2, Z2), and the spatial range identifier (R2).

The user who selected the spatial location identifier (X1, Y1, Z1) and the spatial range identifier R1 will receive weather products and advisories concerning the spatial range identified by the spatial location identifier (X1, Y1, Z1) and the spatial range identifier R1, as predefined in his user input database. The user who selected the spatial location identifier (X2, Y2, Z2) and the spatial range identifier R2 will receive weather products and advisories concerning the spatial range identified by the spatial location identifier (X2, Y2, Z2) and the spatial range identifier R2, and as predefined in the user input database **14**. Likewise, the users who selected the spatial location identifiers (X3, Y3, Z3) and (X4, Y4, Z4) and the spatial range identifiers R3 and R4 will receive weather products and advisories concerning the spatial range identified by the spatial location identifiers (X3, Y3, Z3), (X4, Y4, Z4) and the spatial range identifier R3, R4, and as predefined in the user input database **14**.

The magnitudes of the spatial range identifiers R1, R2, R3 and R4 can be different or the same. In addition, the

magnitudes of the spatial range identifiers R1, R2, R3 and R4 can vary widely and are desirably selected by the users.

Particular users can input the user-defined parameters into the user input database **14** via any suitable method. For example, the user input database **14** is desirably configured to acquire its data from a variety of optional sources preferably chosen by the user, such as verbally through a telephone customer service network, a mobile phone network equipped with wireless application protocol technology, email, a personal digital assistant, a laptop computer, or an interactive web site. Furthermore, users could mail the user-defined parameters to the broadcast network **10**, and an individual at the broadcast network **10** could input the user-defined parameters directly into the user input database **14** via a keyboard or other similar input device. In one embodiment, the user inputs the selected information into the user input database **14** via the user's communicator device **11**.

The weather information database **21** contains real-time weather data for at least the spatial locations contained in the communicator location database **16** and the spatial locations identified by the spatial location identifier in the user input database **14**. The weather analysis unit **12** generates predictions of all weather events based on the real-time weather data. The weather information database **21** desirably receives its real-time weather data from at least one of a plurality of possible resources such as, by way of example but not limitation, government weather information resources, privately operated weather information resources, and other various meteorological resources. The real-time weather data could also be either input directly at the physical location of the weather information database **21** or input via a mobile phone network, a mobile phone network with wireless application protocol, the Internet, aircraft communication systems, email, a personal digital assistant, a laptop computer, regular computer, or other wireless devices.

The communicator location database **16** is an optional feature of the present invention, and is enabled via the signal path **22** when the user requests real-time weather advisories or prediction of events at the dynamic spatial location of the user's communicator device **11**. The communicator location database **16** is continuously updated such that the communicator location database **16** contains real-time data indicative of the spatial locations of the communicator devices **11**. In one embodiment, the user identifier code in the user's profile is transmitted to the communicator location database **16** via the signal path **22**. The communicator location database **16** desirably receives data from the communicator devices **11** identified by the user identifier codes via at least one of a variety of possible resources such as a mobile phone network, a mobile phone network equipped with the wireless application protocol technology, global positioning satellite technology, the Internet, loran technology, radar technology, transponder technology or any other type of technology capable of tracking the spatial location of a communicator device **11** and communicating the location of such communicator device **11** to the communicator location database **16** of the broadcast network **10**. Preferably, the communicator location database **16** is continuously and automatically updated as to the location of each of the communicator devices **11**, such as by the wireless application protocol technology.

The communication network **20** can be, by way of example but not limitation, a mobile phone network, a mobile phone network with wireless application protocol technology, the Internet, a facsimile network, a satellite network (one or two-way), a RF radio network, or any other means of transmitting information from a source to an end user.

The communicator devices **11** can be bidirectional or unidirectional communicator devices. The communicator devices **11** can be, by way of example but not limitation, a portable device, such as a mobile telephone, a smart phone, a pager, a laptop computer or a personal digital assistant, or any other electronic device capable of receiving weather information data. Furthermore, the communicator device **11** can be incorporated into an object that is utilized or accessible by the user, such as a helmet, an automobile, or an airplane, for example. While only three communicator devices **11** are represented in FIG. **1** for purposes of illustration, the interactive weather advisory system **8** contemplates the utilization of a large number of communicator devices **11**.

The weather analysis unit **12** receives the data in the user input database **14**, the communicator location database **16**, and the weather information database **21** from the signal paths **24**, **26**, and **28**. The weather analysis unit **12** can be, by way of example but not limitation, a computer desirably programmed to automatically and continuously compare the data in the user input database **14**, communicator location database **16**, and weather information database **21** so as to generate an individualized weather output signal including weather information within the spatial range identified by the spatial range identifier for each user-defined parameter in the user input database **14**. The weather output signals are transmitted to the communication network **20** via the signal path **32**.

The weather analysis unit **12** gathers the real-time weather data from the weather information database **21**. The term "real-time weather data", as used herein, refers to weather data which is continually updated so as to indicate current or near current information. In some instances, the "real-time weather data" may be delayed by relatively small increments of five minutes, 15 minutes, or 30 minutes, for example. In other instances, the "real-time weather data" can be provided with substantially no delay. It is expected that the increments will become smaller as communication networks and weather related technology become faster.

The weather analysis unit **12** generates predictions of all weather related events and compares past and current events contained in the weather information database **21** (such as future position, strength, trajectory, etc.), to construct a four-dimensional database. Three dimensions of the database define a physical location on or above the earth's surface (the spatial location identifier (X1, Y1, Z1). The fourth dimension is time—past, present or future (identified as T1, T2, T3, T4). By employing high speed computer processors in real-time, the weather analysis unit **12** compares all events (past, current and predicted), at specific positions (X1, Y1, Z1, T1) with identical user supplied data (the user input database—X1, Y1, Z1, R1, T1), and identifies any matches (weather output signals) to the user through the communication network **20** and communication devices **11**.

The communication network **20** receives the weather output signals and the user identification codes via the signal paths **32** and **30**. In response thereto, the communication network **20** transmits the individualized weather output signals to the communicator devices **11** associated with the user identification codes via the signal paths **34***a*, **34***b* and **34***c*, such that each user receives the individualized weather information that was requested.

The signal paths **34***a*, **34***b* and **34***c* refer to any suitable communication link which permits electronic communica-

tions. For example, the signal paths **34***a*, **34***b* and **34***c* can be point-to-point shared and dedicated communications, infra red links, microwave links, telephone links, CATV links, satellite and radio links and fiber optic links.

Various combinations of weather information can be incorporated into the user input database **14** so as to provide the user with selected and specific weather information. For example, a user traveling in his automobile may wish to be informed by the interactive weather advisory system **8** concerning all hailstorms for an area within a 2.5 mile radius of his vehicle as he is traveling from his point of origin to his destination. The user, for example, through his smart phone (communicator device **11**) in his vehicle working in conjunction with a mobile phone network (communication network **20**) with wireless application protocol, inputs selected information into the user input database **14**; namely, the user's smart phone number (user identifier code), hail (weather content identifier), 2.5 mile radius (spatial range identifier **24**) and spatial location dynamic (spatial location of the user's smart phone is then automatically and continuously monitored), and the like.

The interactive weather advisory system **8** then monitors weather information and predictions of events in the weather analysis unit **12**, and transmits the individualized weather output signal to the user's smart phone if a hailstorm is detected or is highly likely to form within a 2.5 mile radius of the vehicle along the vehicle's path of travel, for the duration of travel.

The individualized weather output signal can be an audio and/or video data signal. For example, the individualized weather output signal can be a .WAV file or other suitable file containing an animated representation of a real or hypothetical individual speaking an individualized message to the user. In the example given above, the individualized message may be that the hailstorm is 2.5 miles ahead of the vehicle and thus, the user should consider stopping for a short period of time so as to avoid the hailstorm. Alternatively, the individualized message may be that the hailstorm is 2.5 miles ahead of the vehicle and thus, the user should consider stopping until further notified by another individualized weather output signal so as to avoid the hailstorm. In other words, the weather analysis unit **12** may transmit another individualized weather output signal to the user via the communication network **20** and the communicator devices **11** notifying the user that the weather condition identified by the weather content identifier has passed or is beyond the spatial location identified by the spatial range identifier.

As another example, a user may desire to be informed of all real-time weather data and predictions of events within a particular spatial range of a particular dynamic spatial location. For instance, the user may be interested in whether his aircraft is at risk of icing as he flies from Oklahoma City to Tulsa, Okla. To provide a suitable level of comfort and safety, the user may wish to be informed of icing conditions within 10 miles of the dynamic spatial location of his aircraft. The user, for example, through his smart phone or other suitable avionic device (communicator device **11**) in his aircraft working in conjunction with a mobile phone network (communication network **20**) with wireless application protocol, inputs selected information into the user input database **14**; namely, the user's smart phone number (user identifier code), icing (weather content identifier), 10 mile radius (spatial range identifier **24**), and the spatial location dynamic. The spatial location of the user's smart phone or other suitable avionic device is then automatically and continuously monitored as the aircraft traverses through time and space from (X1, Y1, Z1, T1) to (X4, Y4, Z4, T4). The interactive weather analysis unit **12** then monitors the real-time weather data in the weather information database **21** and the predicted events in the weather analysis unit **12** so as to transmit the individualized weather output signal to the user's smart phone or other avionic device identifying, if icing is detected or is highly likely to form relevant to a 10 mile radius of the aircraft.

As yet another example, perhaps the user is only interested in a particular weather pattern at a particular fixed spatial location and within a particular spatial range irrespective of the immediate location of the communicator device **11**. To accomplish this user's request, the broadcast network **10** does not utilize the communicator location database **16**. The user inputs selected information into the user input database **14**, namely the user's phone number (user identifier code), the code for the particular weather pattern in which the user is interested (weather content identifier), the spatial range around the spatial location in which the user is interested (spatial range identifier), and the spatial location in which the user is interested (spatial location identifier). The weather analysis unit **12** then monitors the real-time weather data in the weather information database **21** and the predicted events in the weather analysis unit **12** so as to transmit the individualized weather information concerning the weather pattern in the spatial location and range requested by the user.

As a further example, perhaps the user is only interested in a particular weather condition at the spatial location and within a particular spatial range at a particular time. The user inputs selected information into the user input database **14**, namely, the user's phone number (user identifier code), the code for the particular weather pattern in which the user is interested (weather content identifier), the spatial range around the spatial location in which the user is interested (spatial range identifier and the spatial location in which the user is interested spatial location identifier) and the time and date (time identifier) that the user to wishes to be informed of the weather conditions at the spatial location of interest. In response thereto, the weather analysis unit **12** monitors the real time weather data from the weather information database **21** for the spatial location and range identified by the spatial range identifier and spatial location identifier to determine the probability of the particular weather pattern occurring at the time identified by the time identifier. The weather analysis unit **12** sends, via the signal path **32**, the individualized weather output signal to the communication network **20**. The communication network **20** receives the user identifier code, via signal path **30**, from the user input database **14** and transmits the weather output signal received from the weather analysis unit **12** to the particular communicator device **11** identified by the user identifier code. Thus, the user receives the individualized weather information concerning the spatial location, spatial range and time requested by the user.

The signal paths **22**, **24**, **26**, **28**, **30** and **32** can be logical and/or physical links between various software and/or hardware utilized to implement the present invention. It should be understood that each of the signal paths **22**, **24**, **26**, **28**, **30** and **32** are shown and described separately herein for the sole purpose of clearly illustrating the information and logic being communicated between the individual components of the present invention. In operation, the signal paths may not be separate signal paths but may be a single signal path. In addition, the various information does not necessarily have to flow between the components of the present invention in the manner shown in FIG. **1**. For example, although FIG. **1**

illustrates the user identifier code being transmitted directly from the user input database **14** to the communication network **20** via the signal path **30**, the user identifier code can be communicated to the weather analysis unit **12** via the signal path **24** and then communicated to the communication network **20** via the signal path **32**.

It should be understood that although the user has been described as manually inputting the user identifier code into the user input database **14**, the user identifier code could be automatically input into the user input database **14** by the communicator device **11**.

Once the user-defined parameters have been input into the user input database **14**, the user-defined parameters can be analyzed by the weather analysis unit **12** along with weather content identifiers for purposes of targeted marketing. A plurality of vendors **36** can be provided access to the weather analysis unit **12** of the broadcast network **10** via a plurality of signal paths **38***a*, **38***b*, and **38***c*. The vendors **36** can independently input search information into the weather analysis unit **12** for compiling a data set of information which is useful to the vendors **36**.

For example, a particular vendor **36***a*, who is in the business of selling snow blowers, may input a weather content identifier and time identifier into the weather analysis unit **12** so as to request a list of all spatial locations in the United States which are expected to receive at least 10 inches of snow in the next week. The weather analysis unit **12** would then compile the data set of all spatial locations in the United States which is expected to receive at least 10 inches of snow in the next week based on at least one weather content identifier, the time identifier, and the real-time weather data stored in the weather information database **21**. The data set is then output to the vendor **36***a*. Based on the data set, the vendor **36***a* may send advertisements or additional snow blowers to the areas identified in the data set.

As another example, the particular vendor **36***a*, who is in the business of selling snow blowers, may input a weather content identifier and time identifier into the weather analysis unit **12** so as to request a list of all user profiles identifying users who resided in spatial locations in the United States which are expected to receive at least 10 inches of snow in the next week. The weather analysis unit **12** would then compile the data set of all spatial locations in United States which is expected to receive at least 10 inches of snow in the next week based on at least one weather content identifier, the time identifier, the user profiles, and the real-time weather data stored in the weather information database **21**. The data set is then output to the vendor **36***a*. Based on the data set, the vendor **36***a* may send advertisements to the users who are identified in the data set.

It is envisioned that users will subscribe to the services provided by the broadcast network **10**. In this regard, the broadcast network **10** may or may not charge a service fee to the users. In addition, some services may be provided by the broadcast network **10** for one charge and additional services may be provided at an enhanced charge.

To save processing power, the weather analysis unit **12** may periodically determine which communicator devices **11** are turned off or out of range. Once this has been determined, the weather analysis unit **12** would then not generate any individualized weather output signals for the communicator devices **11** which are turned off or out of range. Once a particular one of the communicator devices **11** is turned on or comes within range, the weather analysis unit **12** would then attempt to generate individualized weather output signals for such communicator devices **11**. In other words, to save processing power the weather analysis unit **12** may only generate individualized weather output signals for the communicator devices **11** which are active and within range.

The weather analysis unit **12** can be located at the broadcast network **10**. Alternatively, the weather analysis unit **12** can be separate from the remainder of the broadcast network **10** and provided as a service to the broadcast network **10**.

In one preferred embodiment, rather than or in addition to the user providing user-defined parameters to the user input database **14**, the user input database **14** is programmed to provide a plurality of pre-defined user profiles with each of the pre-defined user profiles directed to an activity designated by the user optionally including data and time of the activity. The activity can be a business, personal or recreational need. For example, the business need can be any work dependent upon or impacted by weather conditions to carry out a desired activity, such as, but not limited to a rancher, contractor, farmer, or painter. The personal need can be any activity positively or negatively impacted by weather conditions, such as but not limited to, duties performed by a homeowner, such as mowing the lawn, painting the house, trimming trees, or the like. The recreational need can be any recreational or other outdoor activity dependent upon weather conditions, such as but not limited to golfing, cycling, boating, hiking, fishing, or snow skiing.

In this case, the user selects or provides an activity or category to the user input database **14**. The user input database **14** retrieves pre-defined information concerning such activity or category and stores or links such pre-defined information with the user's user profile. The broadcast network **10** and/or weather analysis unit **12** then functions as set forth above to provide weather alerts or other information concerning the information contained in the user's user profile.

For example, a user may plan on golfing on a particular weekend during the hours of 9:00 a.m. to 4:00 p.m. In this case, the user would select the pre-defined user profile for "golfing", and the time frame of such planned activity. The location of planned activity can also be entered into the user input database **14**, or the location of the communicator device **11** can be monitored by the communicator location database **16**. The information contained in the pre-defined user profile is input into the user input database **14** and output weather alerts and forecasts are then generated as discussed above.

The pre-defined user profiles are determined by member(s) of the broadcast network **10** and/or weather analysis unit **12**, who identify weather conditions which are typically suitable and/or adverse to each designated activity. Thus, for example, a pre-defined user profile for "golfing" will contain data such as wind conditions, lightning, rain, temperature and other conditions which will positively or negatively impact a golfing activity. The data in the pre-defined user profile can be determined either before or after selection of the activity by the user.

If desired by the user, the broadcast network **10** and/or weather analysis unit **12** can assume the responsibility for generating the appropriate size of the spatial range identifier (as in the case with the user profile, or pre-defined user profile). Alternatively, the spatial range identifier can be determined by the nature of the weather event. In the latter case, member(s) of the broadcast network **10** and/or weather analysis unit **12** would determine an "area of concern" around each weather event that would or could occur and the communication network **20** would then send notifications to

any user or communicator device **11** that may come into contact with the area of concern.

For example, a tornado may be ½ mile wide and the broadcast network **10** and/or weather analysis unit **12** would, based upon its experience, knowledge and/or abilities, determine that the area of concern would be 1½ miles wide and 8 miles long—moving northeasterly. Any user contained within the user input database **14** would be notified, as discussed above, if the user's location comes into contact with the "area of concern".

Other Uses of this System

Shown in FIGS. **3-4**, are advisory systems **8***a* and **8***b* which can be used for delivering other types of information or for more accurately predicting weather related events. The advisory systems **8***a* and **8***b* are similar in construction and function to the weather advisory system **8**, except as described below. For purposes of clarity, similar components have been provided with the same numeric prefix, and different alphabetic suffix.

The advisory system **8***a* is provided with a broadcast network **10***a*. In one embodiment, the broadcast network **10***a* is used for transmitting individualized real-time work assignments from, for example, an employer to an employee. The broadcast network **10***a* is provided with an analysis unit **12***a*, a communicator location database **16***a*, and communicator devices **11***a* and **11***b*. The communicator device **11***a* is referred to herein as an "employer communicator device", and the communicator device **11***b* is referred to herein as an "employee communicator device." The communicator location database **16***a* is continuously updated to contain real-time data indicative of the spatial locations of the communicator devices **11***a* and **11***b*. In a similar manner as described above, the analysis unit **12***a* makes comparisons between user profiles (as represented by a box **80***a*), dynamic locations stored in the communicator location database **16***a*, fixed locations as represented by a box **82***a* and job assignments entered into the analysis unit **12***a* from one of the employer communicator devices **11***a*. The system **8***a* may be further described as an employer system **40***a* and an employee system **42***a* to delineate the types of information being conveyed within the system **8***a*.

For example, an employer uses the employer communicator device **11***a* to input employee information and/or criteria into an employee's user profile such as, for example, job location, job schedule, skill set requirements, personality traits, and other criteria as represented by a box **84***a*. Further, the employer inputs work or job assignment criteria into the analysis unit **12***a* such as, for example, job location, job schedule, skill set requirements, personality traits, and other criteria. The employer inputs the above criteria into one of the employer communicator devices **11***a* which may be, for example, a computer, a personal digital assistant (PDA), a cellular phone, a combination cellular phone/PDA, or any other device which may then transmit the employee information and/or job assignment criteria to the analysis unit **12***a*. The analysis unit **12***a* may be, for example, a computer or a web server. The analysis unit **12***a* matches the employee user profile criteria with the work assignment criteria to generate a data set of at least one individualized work assignment.

The individualized real-time work assignment is transmitted to one of the employee communicator devices **11***b* based upon the matching of the work assignment criteria with the employee user-profile. The data set can be transmitted to the employer communicator device **11***a* such that the employer can review the data set to assign the work assignment to a particular one of the employees, or alternatively, the analysis unit **12***a* can automatically assign the work assignment to a particular one of the employees and thereby transmit the work assignment to the employee's communicator device **11***b* without any intervention by the employer. The employee's communicator device **11***b* may be, for example, a PDA, a cellular phone, a combination cellular phone/PDA, a pager, or any other device in which the analysis unit **12***a* or the employer may communicate information to the employee.

The user profile for each of the employees includes information relating to the employee's traits such as, for example, personality, sales style, dress, skill set, location, schedule, or any other quality or trait relating to the particular employee. Further, the user profile is preferably accessible by both the employer communicator device **11***a* and the employee communicator device **11***b*. However, it is preferred that the employer communicator device **11***a* have access to the entire user profile, while the employee communicator device **11***b* only have access to a subset of the user profile. Thus, the user profile accessible by the employer system **40***a* may differ from the user profile accessible by the employee system **42***a*.

For example, the user profile accessible by the employer system **40***a* may include traits related to a particular employee that remain hidden or unknown to the employee. For instance, the employee may have access to information stored in his user profile such as location, schedule, skill set, and other criteria as represented by a box **86***a* and may be provided access to his user-profile to update information as needed. In addition to the above-mentioned employee-accessible information, the employer may have access to the employee user profile to input and access employee traits such as personality, sales style, dress, and skill set and may be provided access to update this information as needed.

In another embodiment, the system **8***a* is used to deliver goods based upon real-time location of a carrier of the goods. More specifically, the system **8***a* can be used to accommodate purchasers of products ordered online in order to quickly and efficiently deliver goods to the purchaser's specified location.

The analysis unit **12***a* is loaded with employee user profiles and locations. The analysis unit **12***a* identifies delivery persons (employees) located near a purchaser's location. Part of the employee's user profile can include an inventory of the goods on the employee's delivery truck. The employee need not know what inventory is located on his delivery truck, but only his delivery destination.

For example, a purchaser may order fresh produce online. The employer may input the purchaser's order (work assignment) into the employer communicator device **11***a* (which inputs the work assignment into the analysis unit **12***a*) so that the analysis unit **12***a* may determine which delivery person may efficiently deliver the specified goods to the purchaser. Also, by ordering online, the purchaser may send his order directly to the analysis unit **12***a* such that the analysis unit **12***a* automatically determines the appropriate delivery person to deliver goods to the purchaser and sends the assignment to the delivery person via the employee's communicator device **11***b*. Further, the employer updates the user profile to track and monitor the precise inventory located on the employee's delivery truck, the inventory being delivered, and any inventory that may be stolen from the delivery truck.

In yet another embodiment, the system **8***a* can be used for sending salesmen to the field for soliciting new clients. For example, a company may receive an inquiry from a sales lead. Information about the lead is entered into the analysis

unit **12***a* as a job assignment from the employer communicator device **11***a*. The analysis unit **12***a* then determines the appropriate salesman to send to the lead based on information stored in the salesman's user-profile. The salesman's user-profile may include information such as salesman location, personality traits, dress style or other attributes used to determine which salesman may be appropriate to send to the lead.

Shown in FIG. **4** is another advisory system **8***b* constructed in accordance with the present invention. The advisory system **8***b* includes a broadcast network **10***b*. The broadcast network **10***b* is similar in construction and function as the broadcast network **10** discussed above, except that the broadcast network **10***b* includes individualized sensor networks **48***a* having weather and environmental sensors **48***b* which are specifically associated with geographic areas associated with predetermined users.

For example, the weather and environmental data collection sites are tremendously sparse in growing areas of the world. In the state of Iowa, only a minimal number of National Weather Service data collection points exist. The scarcity of weather data hinders farmers because a dense grid of weather data points is non-existent in order for farmers to make critical decisions about their crops. For example, how do you know what 160-acre tract of land to fertilize when soil temperature data, crop moisture data, and chance of precipitation data is unavailable?

The sensor network **48***a* includes temporary or permanent data collection sensors **48***b* which may be installed, for example, on a 10 acre to 40 acre grid on the land of a subscriber or user of the system **8***b*. Each sensor **48***b* may have a unique spatial range associated with it such as, for example, a five mile or twenty mile radius. The spatial range associated with each sensor **48***b* can be selected by the user and specified as a result of the sensor **48***b* type and purpose as well as the density of the sensor network **48***a*. For example, if the user is interested in soil moisture in order to schedule a fertilizer treatment, the spatial range associated with the chosen sensor **48***b* may be set, for example, at 375 feet. In another example, the user may be interested in soil temperature for placing seeds in the ground and the desired spatial range associated with the chosen sensor **48***b* may be, for example, 2,000 feet. The user of the system **8***b* includes a user profile as discussed above, which is supplemented with information regarding the sensors **48***b* associated with the user, e.g., installed on or near the user's land. The sensors **48***b* transmit site-specific, individualized information to the weather analysis unit **12***b* so that more detailed information can be used by the weather analysis unit **12***b* in generating the site-specific weather information for the user.

The sensors **48***b* can be any type of sensor which generates information usable for forecasting weather, transmitting current weather conditions, transmitting current environmental conditions, and/or forecasting environmental conditions. For example, the sensors **48***b* can be used to sample or record such parameters as, but not limited to, air temperature, humidity, precipitation, solar radiation, wind speed and direction, soil temperature, soil moisture, and/or chemical constituents in the soil.

For example, a user may enter into his user profile types of information the user would like the sensor network **48***a* to monitor such as, for example, temperature, moisture and/or soil conditions. The weather analysis unit **12***b* receives the sensor data from the sensor network **48***a* and transmits information to the user via the user's communicator device **50***b* based on information entered into his user profile. The user may also choose a specific sensor for monitoring a specific area at any given time by modifying his user profile.

Further, the system **8***b* may be used to transmit real-time road condition information to the weather analysis unit **12***b* to enhance the weather information transmitted to the users of the system **8***b*. Although the sensors **48***b* can include their own power source such as a battery or solar power source, the sensors **48***b* are preferably positioned on a device which has its own electrical power source. For example, a temporary or permanent sensor or sensors **48***b* may be placed in various locations along a roadway such as on a vehicle, on or beside the roadway, on a billboard, gas pump, cell phone tower or sign alongside the roadway or railway, on a delivery vehicle(s) such as, for example, UPS and/or FedEx, or on the streetlights. If the sensor **48***b* is placed on the roadway, it may be placed in the concrete or asphalt. If placed beside the roadway, the sensor **48***b* may be placed in, for example, a ditch. The sensor(s) **48***b* may detect, for example, moisture, temperature or any other weather or environmental condition associated with the roadway, sign alongside the roadway, on streetlights, or on delivery vehicles such as, for example, UPS and/or FedEx, or on railway cars. Alternatively, the sensor(s) **48***b* may be used to detect traffic conditions or any other condition associated with a particular roadway or railway.

For example, each sensor **48***b* may be placed 100 feet away from the nearest sensor in order to create the sensor network **48***a* for determining conditions for a specified area along a roadway or railway. Further, the sensor(s) **48***b* may be placed on various cellular phone towers so that users of a particular cellular phone system associated with the tower may access various conditions using the system **8***b*.

Each of the weather sensors **48***a* can also include a system such as a GPS system for determining the current location of such weather sensor so that the current location of the weather sensor is transmitted to the weather analysis unit **12***b*.

One skilled in the art will recognize many uses of the system **8***b*. For example, when sensor data is collected by sensors **48***a* positioned on moving vehicles along roadways or railways, the weather analysis unit **12***b* can transmit such weather information to communicator devices **11***b* located in close proximity to where the sensor data is being collected. Thus, assuming that a Federal Express truck is located 5 miles from a subscriber, the information collected from the sensor on the Federal Express truck can be transmitted to the subscriber.

From the above description, it is clear that the present invention is well adapted to carry out the objects and to attain the advantages mentioned herein as well as those inherent in the invention. While presently preferred embodiments of the invention have been described for purposes of this disclosure, it will be readily understood that numerous changes may be made which will readily suggest themselves to those skilled in the art and which are accomplished within the spirit of the invention disclosed.

What is claimed is:

1. A method of outputting weather or environmental condition information to a user, the method comprising:

storing user profiles associated with users in a user profile database, the user profiles including a user identifier code for identifying a communicator device associated with a user;

receiving, by a weather analysis unit, weather or environmental condition information from weather and environmental sensors;

receiving real-time data indicative of a spatial location of the communicator device;

storing the real-time data indicative of the spatial location of the communicator device in a communicator location database;

determining whether the communicator device is located in close proximity to a location of one or more of the weather and environmental sensors by:

determining a unique spatial range of each of the one or more weather and environmental sensors; and

determining whether the communicator device is within the unique spatial range of the one or more weather and environmental sensors; and

outputting the weather or environmental condition information received from the one or more weather and environmental sensors in close proximity to the communicator device to a communication network for transmittal to the communicator device in response to a determination that the communicator device is in close proximity to the one or more weather and environmental sensors.

2. The method of claim **1**, wherein the unique spatial range is determined based on a type of the weather or environmental condition information to be monitored by the one or more weather and environmental sensors.

3. The method of claim **1**, wherein the unique spatial range is determined based on a sensor type of the one or more weather and environmental sensors.

4. The method of claim **1**, wherein the unique spatial range is determined based on a distance between the one or more weather and environmental sensors.

5. The method of claim **1**, wherein the weather and environmental sensors are approximately equidistant.

6. The method of claim **1**, wherein one or more of the weather and environmental sensors is mounted on a billboard, a gas pump, a tower for cell phone communication, or a structure supporting a light.

7. The method of claim **1**, wherein one or more of the weather and environmental sensors is mounted on a vehicle.

8. The method of claim **1**, wherein one or more of the weather and environmental sensors is mounted on a billboard.

9. The method of claim **1**, wherein one or more of the weather and environmental sensors is mounted on a gas pump at a gas station.

10. The method of claim **1**, wherein one or more of the weather and environmental sensors is mounted on a tower for cell phone communication.

11. A method of outputting environmental condition information to a user, the method comprising:

storing user profiles associated with users in a user profile database, the user profiles including a user identifier code for identifying a communicator device associated with a user;

receiving environmental condition information from environmental sensors;

receiving real-time data indicative of a spatial location of the communicator device;

storing the real-time data indicative of the spatial location of the communicator device in a communicator location database

determining whether the communicator device is located in close proximity to a location of one or more of the environmental sensors by:

determining a unique spatial range of each of the one or more environmental sensors; and

determining whether the communicator device is within the unique spatial range of the one or more environmental sensors; and

outputting the environmental condition information received from the one or more environmental sensors in close proximity to the communicator device to a communication network for transmittal to the communicator device in response to a determination that the communicator device is in close proximity to the one or more environmental sensors.

12. The method of claim **11**, wherein the unique spatial range is determined based on a type of the environmental condition information to be monitored by the one or more environmental sensors.

13. The method of claim **11**, wherein the unique spatial range is determined based on a sensor type of the one or more environmental sensors.

14. The method of claim **11**, wherein the unique spatial range is determined based on a distance between the one or more environmental sensors.

15. The method of claim **11**, wherein the environmental sensors are approximately equidistant.

16. The method of claim **11**, wherein one or more of the environmental sensors is mounted on a billboard, a gas pump, a tower for cell phone communication, or a structure supporting a light.

17. The method of claim **11**, wherein one or more of the environmental sensors is mounted on a vehicle.

18. The method of claim **11**, wherein one or more of the environmental sensors is mounted on a billboard.

19. The method of claim **11**, wherein one or more of the environmental sensors is mounted on a gas pump at a gas station.

20. The method of claim **11**, wherein one or more of the environmental sensors is mounted on a tower for cell phone communication.

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